Appendix 3.2-A

Feeder Bus Plan

Transportation
Land Development
Environmental
Services

Vanasse Hangen Brustlin, Inc.

99 High Street
Boston, Massachusetts 02110
617 728-7777
FAX 617 728-7782

Memorandum

To: South Coast Project Team

Date: August 2, 2012

Project No.: 10111.34

From: Mike Lambert
Paul Carbone

Re: South Coast Rail: Draft Feeder Bus Plan

This memo describes the proposed feeder bus service plan for each South Coast Rail station for the Stoughton commuter rail alternative and each Rapid Bus station. The following objectives guide this plan:

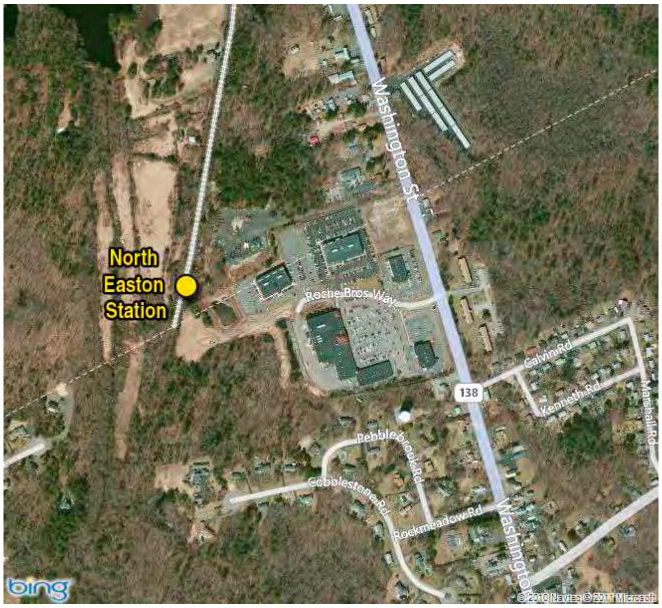
1. Minimize the number of transfers required by transit riders to use the SCR system
2. Identify potential route modifications to existing bus routes to integrate SCR and local bus services to the extent possible
3. Limit route modifications to the extent possible to avoid inconveniencing current bus users
4. For stations served by bus, accommodate buses within the station site and as close as possible to the station platforms
5. Plan for ADA compliant pedestrian connections to bus stops adjacent to the station sites and within the SCR station sites.

Three regional transit authorities, Brockton Area Transit Authority (BAT), the Southeastern Regional Transit Authority (SRTA) and Greater Attleboro Taunton Regional Transit Authority (GATRA) currently provide local bus service to the SCR corridor.

POTENTIAL RAIL STATION FEEDER BUS PROVISIONS

This section provides a description of the recommended Feeder Bus system for each station. Feeder Bus maps specific to each station are included. It proceeds from north to south.

North Easton Station

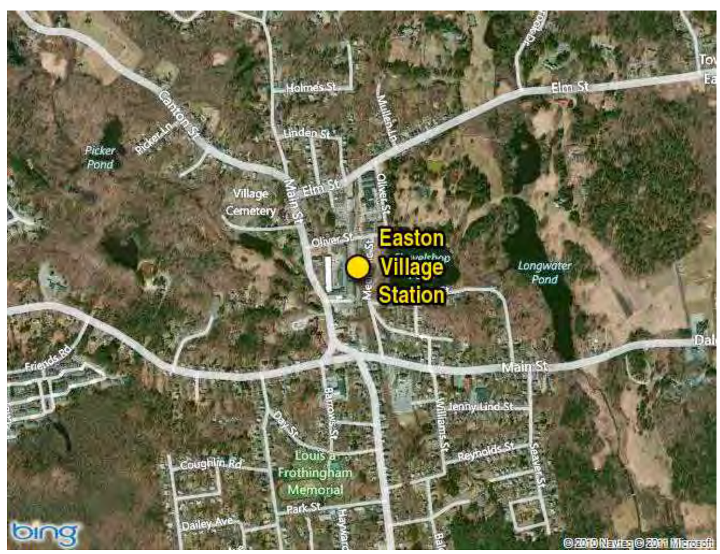


The proposed North Easton Station area is not currently served by public transit. By extending Route #9 from Brockton past its current terminus at Stonehill College it would be possible to provide bus access to this station. However, the Easton Village Station could be connected to the BAT system by the same route and that connection would be shorter and more direct.
For this reason it is not recommended to extend the BAT system to North Easton Station, nor are there other bus systems which could reasonably be extended to serve North Easton Station.

Easton Village Station

The Easton Village Station would be located within the H. H. Richardson Historic District of North Easton. The station area is not currently served by public transit. Brockton Area Transit (BAT) Route #9 currently connects downtown Brockton to two Easton destinations: Stonehill College and Easton Industrial Park.

It is recommended to extend BAT Route #9 less than three miles to Easton Village Station.

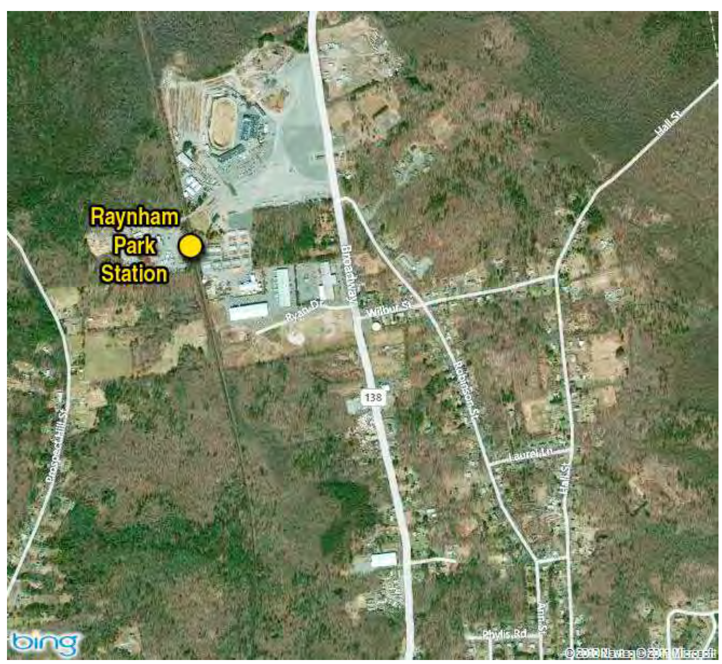


Source: Bing Maps courtesy of ArcGIS Online

Raynham Place Station

The proposed Raynham Park Station area is not currently served by public transit. Bloom Bus operated private commuter bus service from the adjacent Raynham Park entertainment complex to Boston and Taunton, but the SCR connects to both directly.

There are no nearby developments to which bus service could connect that are not more accessible from other SCR stations. Therefore, no modifications to existing bus service are recommended to serve this station.

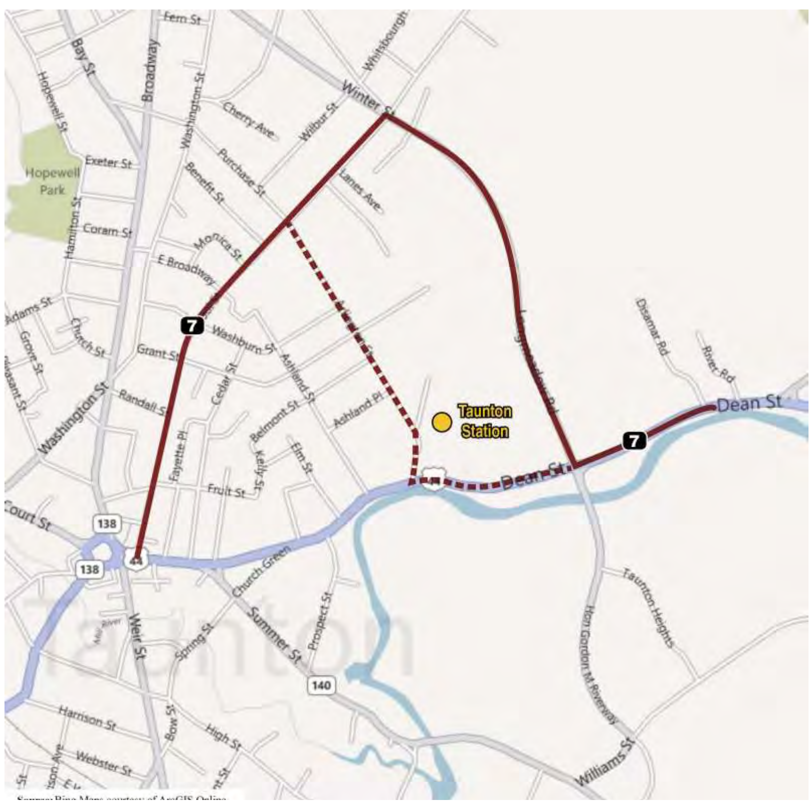


Taunton Station

The proposed Taunton Commuter Rail Station is located .75 miles east of Taunton Green (the center of downtown Taunton), just north of Dean Street/Route 44.

Of the six GATRA routes serving downtown Taunton, none currently stop in the proposed station area. GATRA Route #7 travels in the vicinity of the proposed station, stopping at the intersection of Longmeadow Road and Dean Street, .4 miles east of the station.

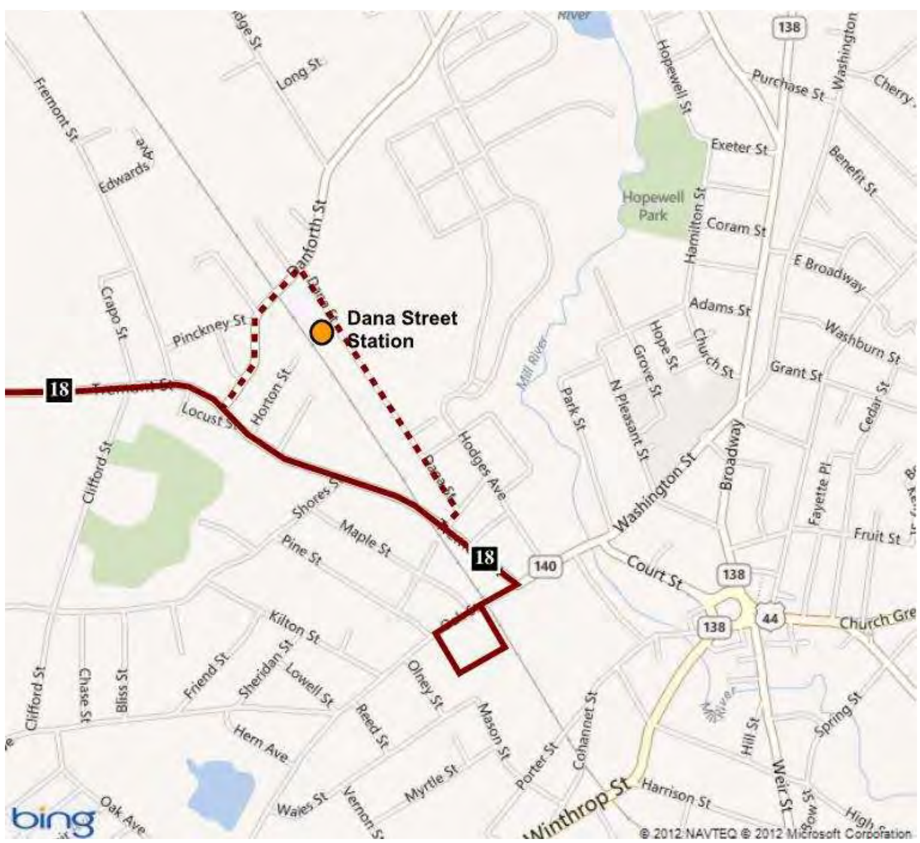
It is recommended that the GATRA Route #7 be realigned from Longmeadow Road to Arlington Street, which would connect directly to Taunton Station. This would establish a basic connection between Taunton Station and Taunton Green operating every 30 minutes on weekdays.



Dana Street Station

The proposed Dana Street Commuter Rail Station is 6/10th of a mile north of the GATRA Bloom Bus Terminal in downtown Taunton. Of the routes serving downtown Taunton, none stop at the proposed station area.

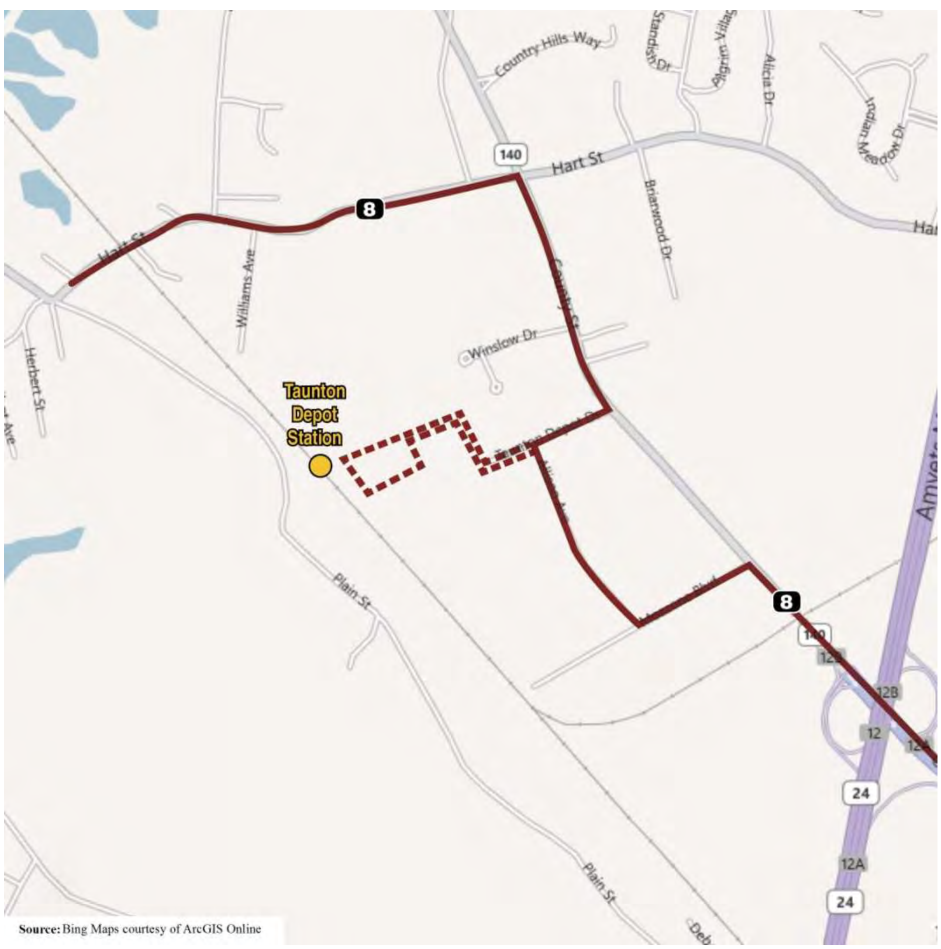
GATRA Route #18 travels along Route 140 and has no stops between Bloom Terminal and Norton Avenue. It is recommended that the GATRA Route #18 be rerouted to connect to Dana Street Station, which would increase Route #18 by 3/10th of a mile and would not eliminate any existing stops. This realignment would provide a bus connection operating approximately every 30 minutes in the peak period and every 80 minutes off-peak.



Taunton Depot

This proposed station area is served by the GATRA Route #8 bus. The route currently extends from County Street to loop through the Taunton Depot shopping center.

Because the walk distance from the front corner of the shopping center building to the station platform is almost 900 feet, it is recommended that a short extension of Route #8 beyond the shopping center and into the station site be provided.

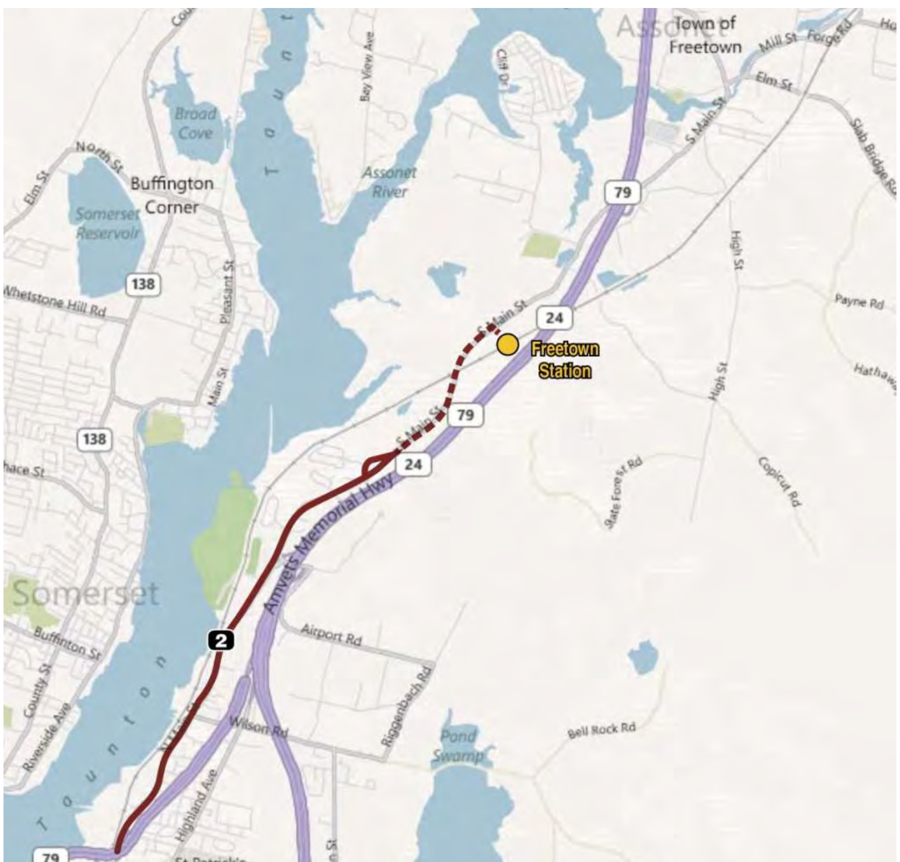


Source: Bing Maps courtesy of ArcGIS Online

Freetown Station

The proposed Freetown Station area is not currently served by public transit. SRTA Route #2 (N. Main Street) travels from downtown Fall River to the Freetown town limits. The route operates on half-hour headways between 5:50 AM and 5:50 PM.

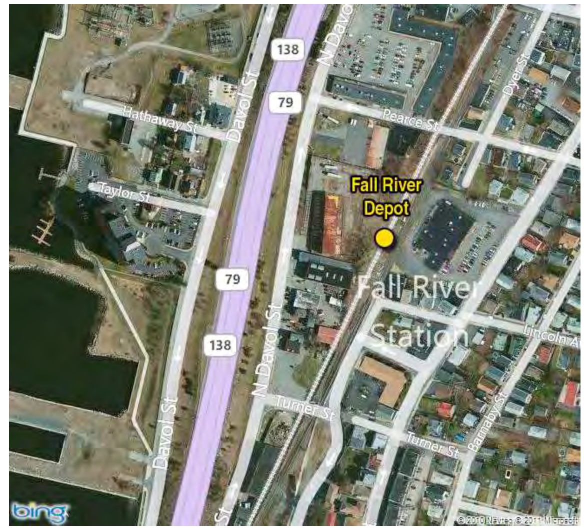
The recommended Freetown Station Feeder Bus Plan includes a 1-mile extension of SRTA Route #2 along S. Main Street, terminating the route at the proposed Freetown station.



Source: Bing Maps courtesy of ArcGIS Online

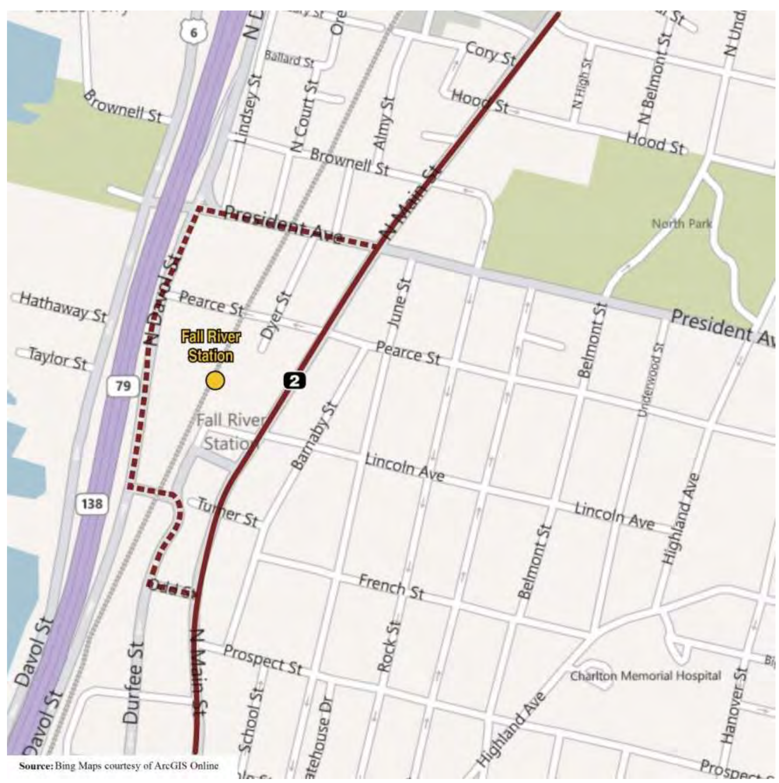
Fall River Depot

The Fall River Depot is planned for the former location of the Fall River Station, a location served by two SRTA routes, the Fall River Industrial Park Route and Route #2. These routes run along Main Street and are well within convenient walking distance to the station platform assuming provision of an adequate pedestrian pathway. Baylies Street could be an acceptable pedestrian route if the station site plan were to meet the path at the corner of Durfee Street and Baylies Street.



Only if an adequate pedestrian pathway between Main Street and the station site cannot be provided, is the recommended alternative to adjust Route #2 and the FR Industrial Park Route to divert at Odd Street to Durfee Street to Turner Street to N. Davol Street, then via President Avenue to return to Main Street.

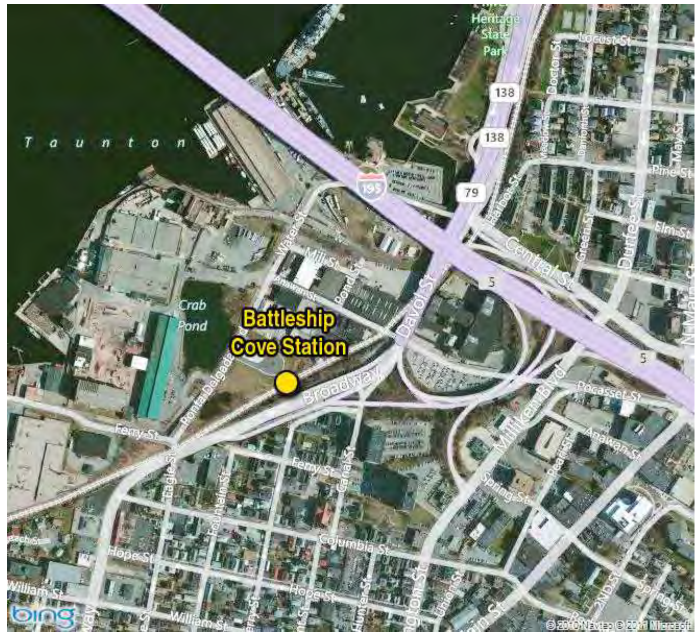
At this point the need for a route deviation is not confirmed. If adequate pedestrian access is available from Main Street the walk distance is convenient (less than 400 feet down Baylies Street) to avoid the need to reroute existing bus service.



Battleship Cove Station

Battleship Cove Station is envisioned as a seasonal station providing access to local tourist attractions. The site is adjacent to Broadway, a divided highway that forms a barrier to pedestrians from or to the east.

Buses do not currently operate west of Broadway in this area. Due to the seasonal nature of this station, its function to provide access to Battleship Cove and the proximity of Fall River Depot to provide commuter service year round, no feeder bus service to this station is recommended.



King's Highway Station

The King's Highway Station is set amid regional shopping destinations separated by expansive parking lots. Store parking lots are accessed from King's Highway/Tarkiln Road. The station site is located between two retail properties.

SRTA Route #8 (Mount Pleasant) connects to the station area at its northern terminus, the Fieldstone Marketplace. Route #8 travels between the station area and downtown New Bedford. Therefore no modification to Route #8 is needed.

Source: Bing Maps courtesy of ArcGIS Online

Whale's Tooth Station

Whale's Tooth Station is the eastern terminal station for South Coast Rail, located adjacent to downtown New Bedford. A Transit Development Plan (Draft) has been developed for the SRTA bus system that serves New Bedford.

As part of that analysis modifications to the proposed SRTA bus system that would link SCR via Whale's Tooth Station to SRTA were recommended. Those recommendations are described below.

Route #1 – Fort Rodman would now travel through the downtown on the inbound trips via Pleasant Street before turning right onto Hillman Street. Route #1 would then turn left into Acushnet Avenue and proceed to the Whale's Tooth station.
Outbound trips would depart the Whale's Tooth Station traveling south on Acushnet Avenue. They would turn right onto Hillman Street and then left onto Pleasant Street. Route #1 would travel into downtown via Sixth Street and then continue along the routing for Option A.

Route #2 – Lund's Corner would be interlined with route #1. The inbound route would terminate at Whale's Tooth, no longer traveling into downtown. Outbound route #2 would depart from Whale's Tooth and travel north.

Route #3 – Ashley Boulevard would travel north through downtown before terminating at the Whale's Tooth station. Inbound trips would travel north past the existing terminal on Pleasant Street before turning right onto the transit-only bridge at Pearl Street and into Whale's Tooth station. Outbound trips would depart from Whale's Tooth station and travel west on the transit-only bridge and then left onto Pleasant Street.

Route #4 – Ashley Boulevard would no longer travel into downtown once the Whale's Tooth Station is functional. Inbound trips would follow their existing routing before turning left from Purchase Street onto the new transit-only bridge at Pearl Street. The route would then terminate at Whale's Tooth.
Outbound trips would depart Whale's Tooth and travel west across the transit-only bridge and right onto Purchase Street. Two of the outbound trips (1 morning and 1 evening) would travel to the Industrial Park, and two trips (1 morning and 1 evening) would travel to the North End.

Route #6 – Shawmut-Rockdale would become interlined with the Route #11. This change would result in a decreased headway of 30 minutes. Route #6 would continue the two variations in Option A, Rockdale and Shawmut. Inbound trips would travel through downtown and north along Pleasant Street/Purchase Street. The route would then access Whale's Tooth via the transit-only bridge at Pearl Street.

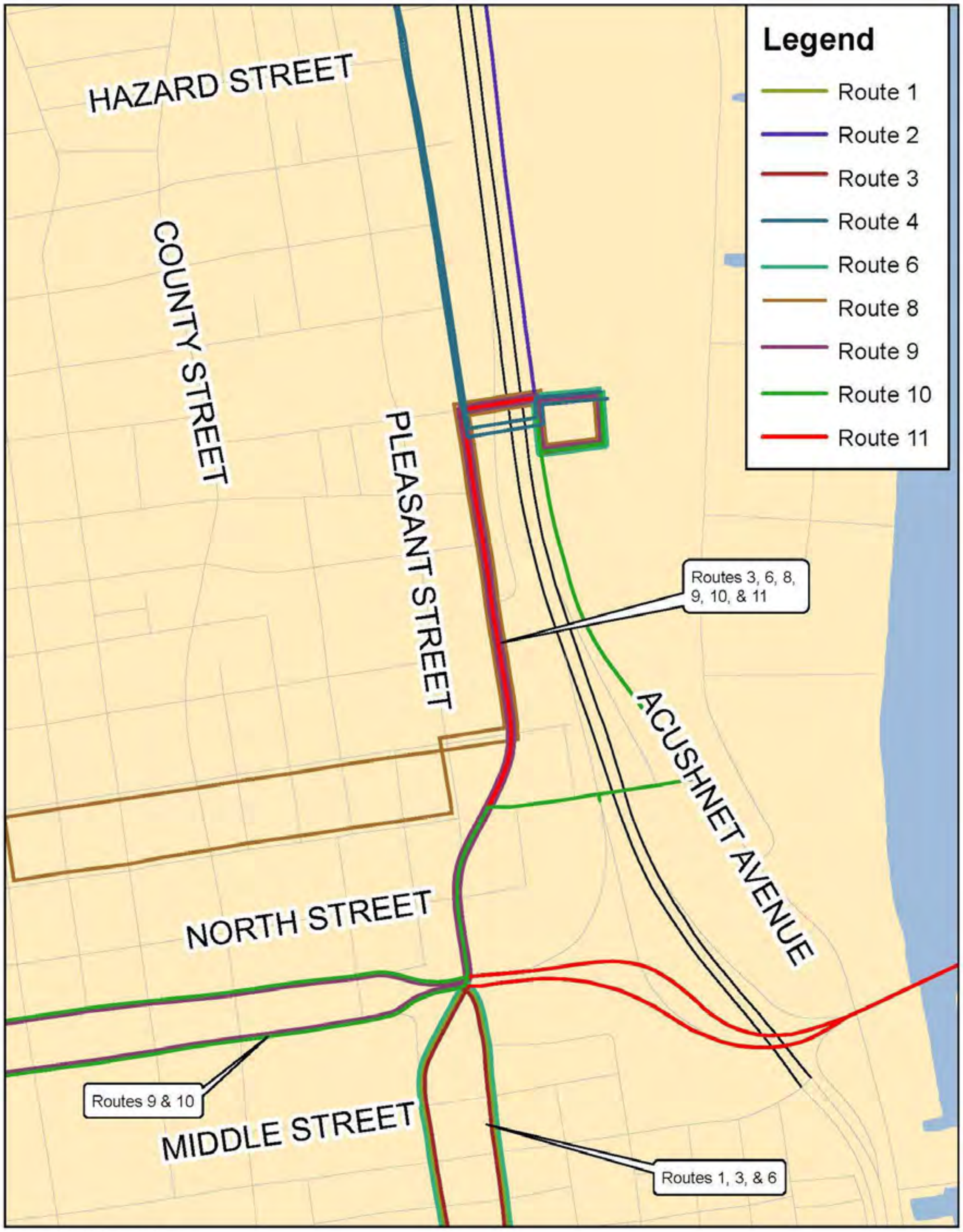
Outbound trips would depart Whale's Tooth and travel west across the transit-only bridge and left onto Purchase/Pleasant Street. The route would continue onto Sixth Street and into downtown, following the routing in Option A. The outbound trips would alternate between traveling to Rockdale and Shawmut.

Route #8 – Mt. Pleasant would change its routing to access Whale's Tooth. The inbound route currently travels south along Cottage Street before turning east onto Kempton and into downtown. The inbound route would continue south on Cottage as it does currently, but instead would turn east at Hillman Street, left onto Pleasant Street, and then right onto Maxfield Street. From Maxfield the route would travel north along Purchase Street before turning right onto the transit-only bridge and into Whale's Tooth.
The outbound trips would depart Whale's Tooth, cross the transit-only bridge and turn south onto Purchase Street. Route #8 would then travel west along Maxfield and then north onto Cottage Street. From there, route #8 would continue its existing routing.

Route #9 – New Bedford to Fall River would no longer travel into downtown. Inbound trips would travel east along Kempton before turning north onto Pleasant Street. The route would continue through on Purchase Street. Route #9 inbound trips would use the transit-only bridge to access Whale's Tooth from Purchase Street.
Outbound trips would follow a similar routing in reverse. Departing Whale's Tooth, route #9 would cross the transit-only bridge and turn south onto Purchase Street. The route would then continue onto Pleasant Street and turn west onto Mill Street.

Route #10 – Dartmouth Mall inbound trips would travel east on Kempton before turning north onto Pleasant Street. The route would continue through onto Purchase and turn east onto Hillman. Route #10 then turns north onto Acushnet and into Whale's Tooth.
Route #10 outbound trips would depart Whale's Tooth and travel south along Acushnet. Route #10 then turns west on Hillman Street and then south onto Purchase/Pleasant from which the route would turn west onto Mill Street.

Route #11 – Fairhaven would no longer serve downtown New Bedford. The route would travel west on U.S. 6 (Mill Street) before turning north onto Pleasant Street. Route #11 would continue through on Purchase Street and would access Whale's Tooth via the transit-only bridge at Pearl Street. As mentioned above, this route would be interlined with route #6, resulting in a 30-minute headway.
Outbound trips would depart Whale's Tooth and travel west on the transit-only bridge and then south on Purchase Street. The route would continue through onto Pleasant Street before turning east onto U.S. 6.



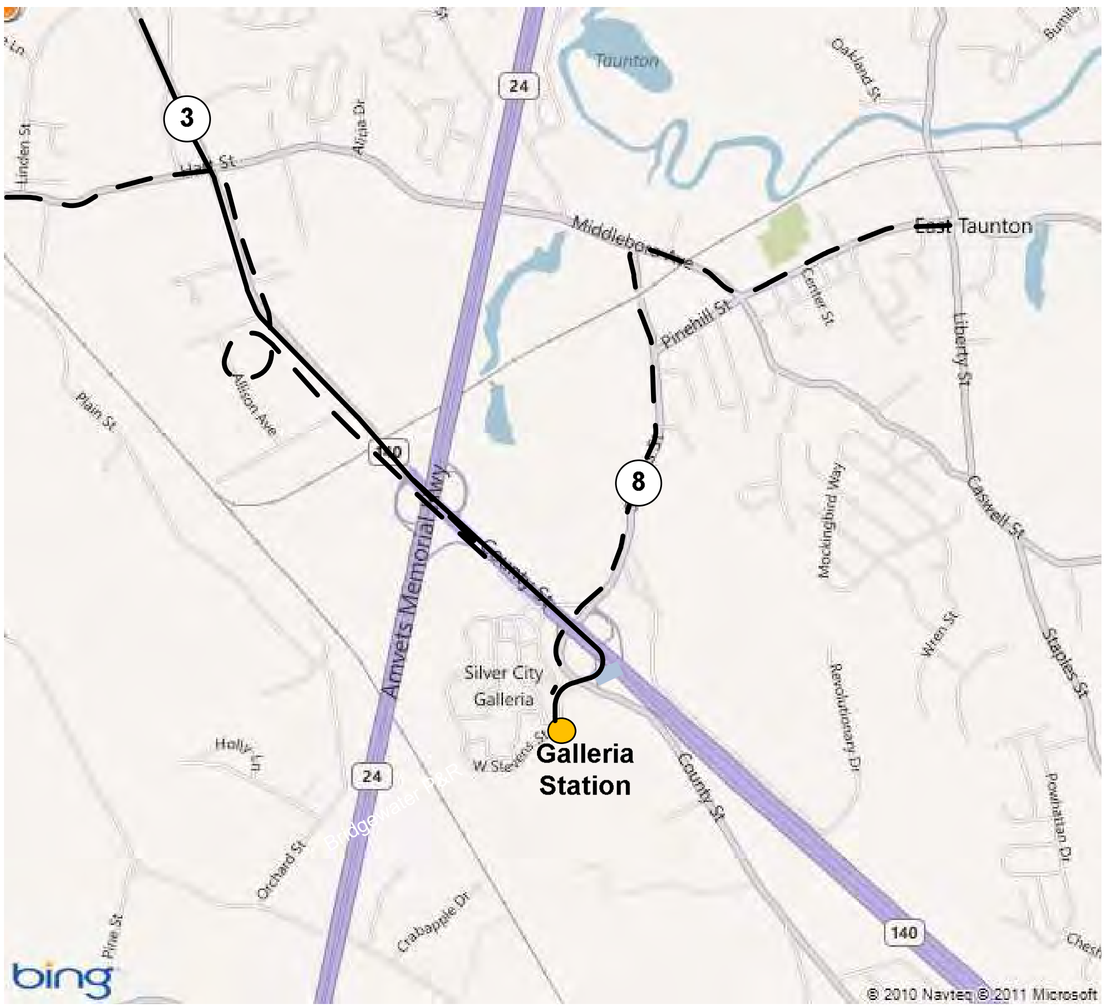
Source: MassGIS and VHB, Inc.

POTENTIAL RAIL STATION FEEDER BUS PROVISIONS

The Rapid Bus Alternative would serve the same station locations for the Whales Tooth, King's Highway Station, Fall River Depot, and Freetown Stations. The same feeder bus service would be provided. In addition stations would be provided at Galleria, Raynham and Easton with the Rapid Bus Alternative.

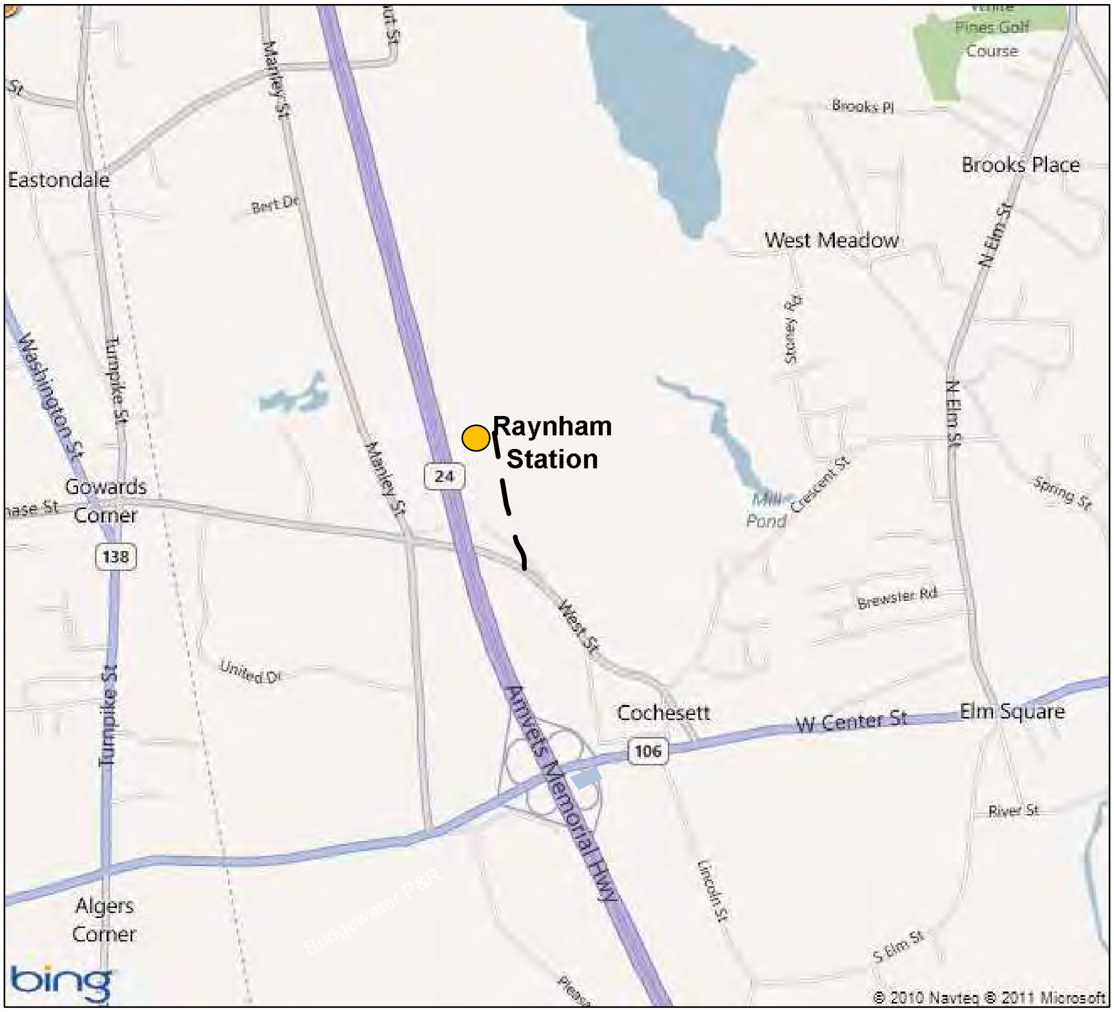
Galleria Station

The Galleria Station would be located in the current site of the bus park and ride in the Silver City Galleria site. Buses destined for South Station would originate at this station and proceed north on the Rapid Bus guideway to Raynham and Easton Stations before continuing to South Station. GATRA routes # 8 and 3 serve the mall and the park and ride



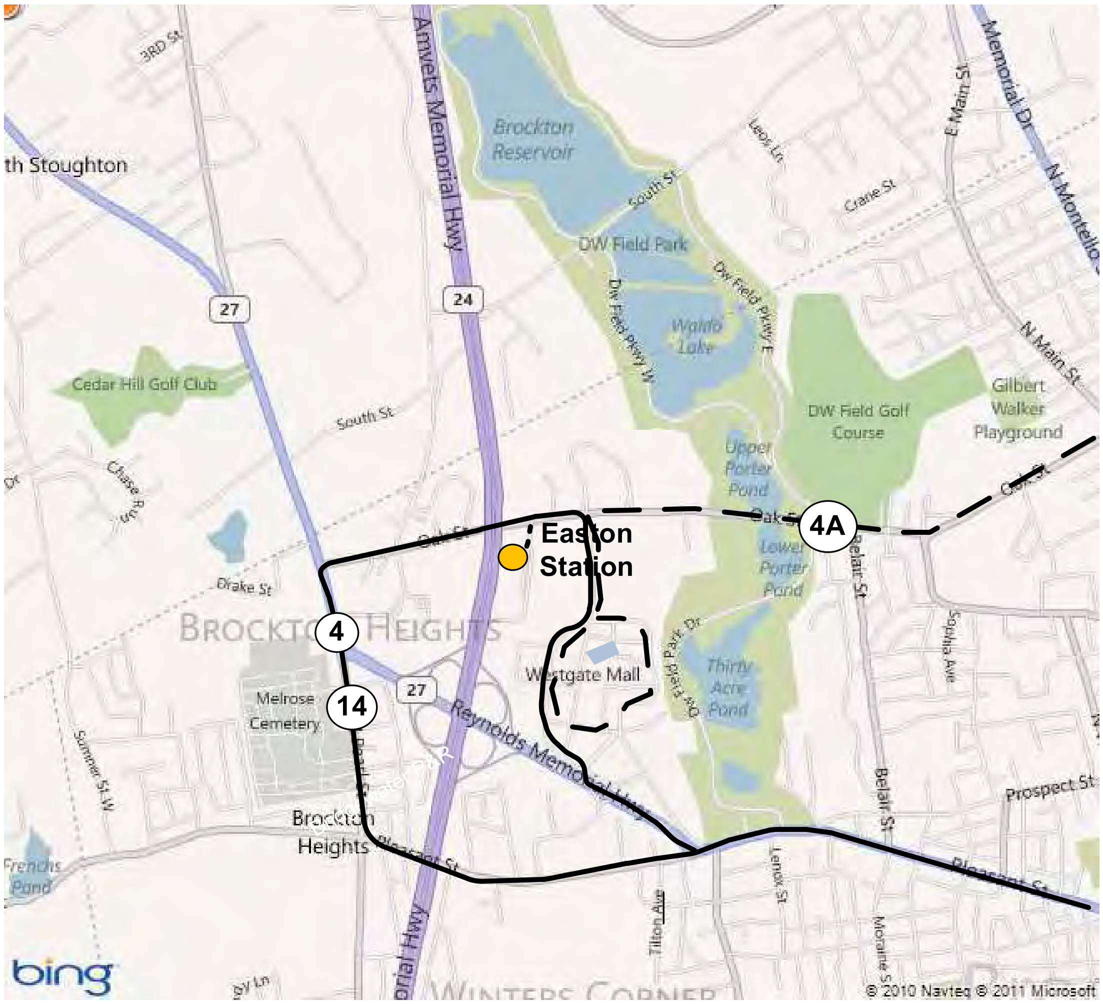
Raynham Station

The Raynham Station would be located off of West Street where it crosses under Route 24. An access road would be constructed to the station site which must be located as shown to avoid wetlands impacts. This would be an on-line station, with the Rapid Bus buses rising from the median guideway to access the elevated platforms of the station. There are no buses routes in the vicinity of this station site.



Easton Station

The Easton Station would be located north of Westgate Mall. This would also be an on-line station, with the Rapid Bus buses rising from the median guideway to access the elevated platforms of the station. BAT routes #4, 4A and 14 currently serve West Gate at the Dick's Sporting Goods store site. It is proposed that this route would be extended to the Rapid Bus Easton Station as shown in the following site map.



Appendix 3.2-B

Bridge Summary

Bridge Summary

1 New Bedford Mainline Bridges

1.1 No Work Bridges

The following is a list of bridge crossings (both undergrade and overhead) that would not require rehabilitation or reconstruction as part of the currently envisioned South Coast Rail project:

- Howland Road (M.P. 43.26) – Overhead
- Route 140 (M.P. 50.66) – Overhead
- Deane Street (M.P. 53.31) – Undergrade
- Sawyer Street (M.P. 53.57) – Undergrade
- Coggeshall (M.P. 53.67) – Undergrade
- Cedar Grove Street (M.P. 53.79) – Undergrade
- I-195 Ramp (M.P. 53.81) – Overhead
- Weld Street/Route 18 Ramp (M.P. 53.95) – Undergrade
- Logan Street (M.P. 54.01) – Undergrade

1.2 Bridges Requiring Rehabilitation or Reconstruction

The following is a list of bridge crossings (both undergrade and overhead) that require rehabilitation or reconstruction as part of the currently envisioned South Coast Rail project:

1.2.1 Taunton River (M.P. 35.56)

The bridge over the Taunton is a four-span structure carrying a single active track. One span consists of a steel plate thru girder structure, while the other three spans consist of steel stringers supporting a timber deck. The three piers are steel bents supported by HP piles.

The bridge requires reconstruction as it does not rate for Cooper E80 loading and cannot accommodate the two tracks as currently proposed. The structure is envisioned to be a two-span, two-bay, ballasted steel plate thru girder superstructure carrying two sets of tracks. There would be three total girders, with two exterior and one common interior girder. New cast-in-place concrete abutments would be constructed behind the existing abutments, increasing the span length. The existing abutments would be partially removed to an elevation equal to the river's average seasonal high water elevation. The space between the existing and proposed abutments would be graded to reconnect the stream banks on either side of the bridge. The existing piles would be removed to one foot below grade.

The construction staging of this bridge would follow the typical sequence for single existing track, two proposed track scenarios (see Alternatives Description Section 4.3). During the first stage, one bay of the new thru girder superstructure must be constructed adjacent to the existing thru girder structure. This will require that the Track 1 alignment be far enough away from the existing structure to allow construction of the first bay, maintaining horizontal clearance as necessary for erection and safe rail operation. The alignment of the second track would be determined by that of the first, as the two bays share the interior plate girder.

1.2.2 Brickyard Road (M.P. 35.79)

The bridge over Brickyard Road is a single-span, multiple steel stringer structure with an open deck. The west superstructure carries one active track. The east superstructure appears to be older and is not currently in service.

This bridge currently rates for Cooper E80 loading, but reconstruction is recommended to reduce future maintenance costs. The proposed structure is envisioned to be a single-span ballasted precast box girder superstructure carrying two sets of tracks. The existing stacked stone abutments could likely be reused but would require rehabilitation, as well as some geometric modifications to the backwalls and bearing areas.

The construction staging of this bridge would follow the typical sequence for single existing track, two proposed track scenarios (see Alternatives Description Section 4.3). After the eastern superstructure is demolished, a portion of the new precast box girder superstructure must be constructed adjacent to the existing structure, maintaining horizontal clearance as necessary for erection and safe rail operation. This would require that the final superstructure be wide enough to support the Stage 1 track alignment as well as the final track alignments. The box girders would be transversely post-tensioned after each stage of new construction to ensure adequate distribution of structural live loads.

1.2.3 Route 24 (M.P. 37.69)

The Route 24 Bridge over the railroad right of way is a single-span reinforced concrete rigid frame structure carrying Route 24 Northbound and Southbound as well as a center median. The bridge currently crosses one active track.

The bridge requires reconstruction as it does not provide adequate horizontal clearance to accommodate the two proposed sets of tracks. A type study would be required to determine the preferred structure type. The demolition and construction would require coordinated staging of both Route 24 and the active railroad underneath.

1.2.4 Cotley River (M.P. 38.93)

The bridge over the Cotley River is a single-span steel plate girder structure currently carrying a single active track.

The bridge requires reconstruction as it does not rate for Cooper E80 loading. The proposed structure is envisioned to be a single-span ballasted steel tub superstructure carrying two sets of tracks. New cast-in-place concrete abutments would be constructed behind the existing abutments, increasing the span length. The existing abutments would be partially removed to an elevation equal to the river's average seasonal high water elevation. The space between the existing and proposed abutments would be graded to recreate the stream banks on either side of the bridge.

The construction staging of this bridge would follow the typical sequence for single existing track, two proposed track scenarios (see Alternatives Description Section 4.3). During the first stage, a portion of the new steel tub superstructure must be constructed adjacent to the existing structure, maintaining horizontal clearance as necessary for erection and safe rail operation. Given the narrow width of the existing structure, this should not require greater track spacing than the minimum 14'-0" at any point during construction.

1.2.5 Cotley River (M.P. 39.46)

The bridge over the Cotley River is a single-span steel plate girder structure currently carrying a single active track.

The bridge requires reconstruction as it does not rate for Cooper E80 loading. The proposed structure is envisioned to be a single-span ballasted steel tub superstructure carrying two sets of tracks. New cast-in-place concrete abutments would be constructed behind the existing abutments, increasing the span length. The existing abutments would be partially removed to an elevation equal to the river's average seasonal high water elevation. The space between the existing and proposed abutments would be graded to recreate the stream banks on either side of the bridge.

The construction staging of this bridge would follow the typical sequence for single existing track, two proposed track scenarios (see Alternatives Description Section 4.3). During the first stage, a portion of the new steel tub superstructure must be constructed adjacent to the existing structure, maintaining horizontal clearance as necessary for erection and safe rail operation. Given the narrow width of the existing structure, this should not require greater track spacing than the minimum 14'-0" at any point during construction.

1.2.6 Assonet River (Cedar Swamp)(M.P. 42.14)

The bridge over the Cedar Swamp River is a two-span timber girder structure currently carrying a single active track. The abutments and pier are timber bents founded on timber piles.

This bridge was replaced in 2011 with a new timber superstructure, timber pile caps, timber pile posts and back walls. However, the timber piles in the ground are original.

The current bridge rates for Cooper E78 loading. However, replacement can be considered to upgrade the foundation. The proposed structure is envisioned to be a single-span ballasted steel tub superstructure carrying a single track. New cast-in-place concrete abutments would be constructed behind the existing abutments, increasing the span length. The existing abutments would be partially removed to an elevation equal to the river's average seasonal high water elevation. The space between the existing and proposed abutments would be graded to reconnect the stream banks on either side of the bridge. The existing piles would be removed to one foot below grade.

The construction staging of this bridge would follow the typical sequence for single existing track, single proposed track scenarios (see Alternatives Description Section 4.3). During the first stage, a portion of the new steel tub superstructure must be constructed adjacent to the existing timber girder structure, maintaining horizontal clearance as necessary for erection and safe rail operation. This would require that the final superstructure be wide enough to support the stage one track alignment as well as the final track alignment.

1.2.7 Fall Brook (Freetown Brook)(M.P. 45.43)

The bridge over the Fall Brook is a single-span steel girder structure, currently carrying a single active track.

The bridge requires reconstruction as it does not rate for Cooper E80 loading. The proposed structure is envisioned to be a single-span ballasted steel tub superstructure carrying a single track. New cast-in-place concrete abutments would be constructed behind the existing abutments, increasing the span length. The existing abutments would be partially removed to an elevation equal to the brook's average seasonal high water elevation. The space between the existing and proposed abutments would be graded to recreate the stream banks on either side of the bridge.

The construction staging of this bridge would follow the typical sequence for single existing track, single proposed track scenarios (see Alternatives Description Section 4.3). During the first stage, a portion of the new steel tub superstructure must be constructed adjacent to the existing steel girder structure, maintaining horizontal clearance as necessary for erection and safe rail operation. This would require that the final superstructure be wide enough to support the stage one track alignment as well as the final track alignment.

1.2.8 Route 18 (M.P. 54.17)

The bridge over Route 18 is a two-span thru plate girder structure supporting a ballasted deck. It currently carries a single active track. The abutments and pier are reinforced concrete.

The bridge requires reconstruction due to the proposed track alignment. . The proposed structure is envisioned to be a single-span ballasted steel plate thru girder superstructure carrying a single track. It is anticipated that new cast-in-place concrete abutments and pier would be required to accommodate the new track alignment.

It is assumed that track would be deactivated from Route 18 to the Terminus, allowing unimpeded construction along the segment.

1.2.9 Wamsutta Street (M.P. 54.21)

The bridge over Wamsutta Street and Acushnet Avenue is a three-span steel plate thru girder structure. The structure originally supported four superstructure bays, but the two western bays and half of the eastern interior bay have been removed. The eastern exterior bay, supported by two thru girders, carries the single active track across the bridge.

The bridge requires reconstruction as it does not rate for Cooper E80 loading. The proposed structure is envisioned to be single-span ballasted steel thru girder superstructure carrying one track. The existing southern gravity abutment and northern reinforced concrete abutment (shared with the Route 18 crossing) can likely be reused but would require rehabilitation to accommodate the increased loads, as well as some geometric modifications to the backwalls and bearing areas.

It is assumed that track would be deactivated from Route 18 to the Terminus, allowing unimpeded construction along the segment.

2 Fall River Secondary Bridges

2.1 No Work Bridges

The following is a list of bridge crossings (both undergrade and overhead) that would not require rehabilitation or reconstruction as part of the currently envisioned South Coast Rail project:

- Route 24/79 (M.P. 45.58) – Undergrade
- South Main Street/Route 79 (M.P. 46.25) – Overhead
- Clark Street (M.P. 48.93) – Overhead
- Canedy's Underpass (M.P. 49.57) – Undergrade
- New Street (M.P. 49.81) – Overhead
- Western Expressway/Route 79 (M.P. 49.96) – Overhead
- Western Expressway Ramps (M.P. 50.06) – Overhead
- Weaver Street (M.P. 50.09) – Overhead
- Cove Street (M.P. 50.43) – Undergrade
- Clinton Street (M.P. 50.49) – Undergrade
- Brightman Street (M.P. 50.69) – Overhead
- Central Street (M.P. 52.05) – Overhead
- NB Ramp (M.P. 52.05) – Overhead
- SB Ramp (M.P. 52.06) – Overhead
- I-195 (M.P. 52.07) – Overhead
- Route 138 / Davol Street (M.P. 52.09) – Overhead
- Western Expressway, NB & SB (M.P. 52.09) – Overhead
- Anawan Street (M.P. 52.19) – Overhead

2.2 Bridges Requiring Rehabilitation or Reconstruction

The following is a list of bridge crossings (both undergrade and overhead) that require rehabilitation or reconstruction as part of the currently envisioned South Coast Rail project:

2.2.1 Cedar Swamp River (M.P. 41.51)

The bridge over the Cedar Swamp River is a three-span steel stringer structure supporting an open deck. The abutments and piers are stone masonry. It currently carries a single active track.

The bridge requires reconstruction as it does not rate for Cooper E80 loading. The proposed structure is envisioned to be a single-span ballasted steel plate thru girder superstructure, supported on pile supported, cast-in-place concrete abutments, carrying a single track. The existing concrete piers would be removed to two feet below the river's mud line elevation. The proposed abutments would be located behind the existing. The existing abutments would be partially removed to an elevation equal to the mean spring high tide, permitting the recreation of river bank on both sides of the bridge.

Due to the surrounding wetland resource areas, it is not feasible to construct a temporary track while the bridge is rebuilt. This would require constructing the proposed bridge within track outage windows. The following paragraphs describe the general construction methods and sequencing that would be used to construct the bridge:

1. Install Erosion Controls and Selective Trimming of Vegetation: Erosion controls (staked, embedded siltation fencing and/or hay bales) would be installed along the river banks at both ends of the bridge. Vegetation within the limit of work would be cleared and tree branches trimmed to prepare the work area. Any remaining ties or rail would be removed and disposed of in accordance with Massachusetts regulations.

2. New Bridge Substructure: The steel h-piles designed to support the bridge substructures would be installed outside the limits of the existing track and stone abutments. The substructure concrete would be installed during a track outage. The abutments would then be backfilled and the existing rail would be reinstalled.

3. New Bridge Thru-girders: The envisioned bridge consists of steel thru-girders, which would be located outside the limits of the existing bridge superstructure. Likewise, these girders would be installed onto the newly constructed bridge abutments without impacts to the existing track.

4. Realignment of Existing Track: The vertical alignment of the existing track would be realigned to match the proposed track profile in the vicinity of the bridge. This construction would occur within periodic track outages. Timber cribbing would be installed onto the existing steel stringers to raise the track profile to match the proposed.

5. New Superstructure Installation: Work associated with the installation of the new deck beams, ballast plate, new ballast and rail would all occur within

periodic track outages. This portion of the construction sequencing would focus on small (approx. 20ft) sections of track at a time. These sections would correspond to the existing bridge's span configuration.

a. Between days of active rail, the newly realigned tracks, ties, cribbing and a portion of the bridge superstructure would be removed. New floor beams would be installed, timber cribbing would be reinstalled onto the new floor beams, and track would be installed and reconnected, all in time for track service to resume. This process would repeat until the entire existing bridge had been removed.

b. Then, the staging process would repeat. In sections, the track and timber cribbing would be removed and new steel ballast plate, membrane waterproofing, and ballast would be installed. New rail would be installed and connected to the existing to allow track service to resume. This process would repeat until the new bridge construction was complete.

2.2.2 Farm Road (M.P. 46.53)

The bridge over Farm Road is a single-span steel stringer structure supporting an open deck. It currently carries a single active track.

The bridge requires reconstruction as it does not rate for Cooper E80 loading. The proposed structure is envisioned to be a single-span ballasted steel tub superstructure carrying a single track. The existing stacked stone abutments can likely be reused but must be rehabilitated and widened to accommodate the new, wider superstructure.

The construction staging of this bridge would follow the typical sequence for single existing track, single proposed track scenarios (see Alternatives Description Section 4.3). During the first stage, a portion of the new steel tub superstructure must be constructed adjacent to the existing steel stringer structure, maintaining horizontal clearance as necessary for erection and safe rail operation. This would require that the final superstructure be wide enough to support the stage one track alignment as well as the final track alignment.

2.2.3 Farm Road (M.P. 47.75)

The bridge over Farm Road is a single-span steel stringer structure supporting an open deck. It currently carries a single active track.

The bridge does not rate for Cooper E80 loading. Given that the road spanned by the bridge is abandoned, the bridge can be filled in. The culvert through the south abutment would be maintained / rehabilitated.

2.2.4 Golf Cart Road (M.P. 47.90)

The Golf Cart Road is currently a grade crossing.

The proposed overhead bridge is envisioned to be a single-span concrete deck supported on steel stringers. The bridge would be designed to support only pedestrian traffic as well as emergency vehicles only. The abutments would most likely consist of cast-in-place reinforced concrete.

2.2.5 Golf Club Road (M.P. 48.11)

The Golf Club Road Bridge over the railroad right of way is currently a three-span steel thru girder structure.

The bridge requires reconstruction because the existing piers obstruct the proposed horizontal alignment. The proposed overhead bridge is envisioned to be a single-span steel stringer superstructure supporting a concrete deck. The structure accommodates two 11′-0″ lanes as well as a single 5′-0″ sidewalk. New cast-in-place concrete abutments are likely to be required, due to the current condition of the existing abutments and increased loading due to the proposed longer span.

2.2.6 Miller's Cove Road (M.P. 48.62)

The bridge over Miller's Cove Road is a single-span, ballasted, reinforced concrete slab bridge. It carries one active track.

The bridge requires reconstruction as it does not rate for Cooper E80 loading. The proposed structure is envisioned to be a single-span ballasted steel tub superstructure carrying a single track. The existing stacked stone abutments with concrete facing are in poor condition. New cast-in-place concrete abutments are likely to be required, due to the current condition of the existing abutments.

The construction staging of this bridge would follow the typical sequence for single existing track, single proposed track scenarios (see Alternatives Description Section 4.3). During the first stage, a portion of the new steel tub superstructure must be constructed adjacent to the existing reinforced concrete structure, maintaining horizontal clearance as necessary for erection and safe rail operation. This would require that the final superstructure be wide enough to support the stage one track alignment as well as the final track alignment.

2.2.7 Collins Road (M.P. 49.06)

The bridge over Collins Road is a single-span thru girder structure with an open deck. The structure originally consisted of two bays, but only the eastern bay remains, carrying a single active track.

The bridge requires reconstruction as it does not rate for Cooper E80 loading and provides inadequate horizontal clearance. The proposed structure is envisioned to be a single-span ballasted steel tub superstructure carrying a single track. The existing stacked stone abutments can likely be reused but require rehabilitation and widening to support the wider superstructure.

The construction staging of this bridge would follow the typical sequence for single existing track, single proposed track scenarios (see Alternatives Description Section 4.3). During the first stage, a portion of the new steel tub superstructure must be constructed adjacent to the existing thru girder structure, maintaining horizontal clearance as necessary for erection and safe rail operation. This would require that the final superstructure be wide enough to support the stage one track alignment as well as the final track alignment.

2.2.8 Ashley's Underpass (Ashley Street)(M.P. 49.21)

The bridge over the dirt path near Ashley Street is a single-span, timber stringer structure with an open deck. A timber bent has been added adjacent to the south abutment. It currently carries one active track.

The bridge requires reconstruction as it does not rate for Cooper E80 loading and provides inadequate horizontal clearance. The proposed structure is envisioned to be a single-span ballasted steel tub superstructure carrying a single track. The existing stacked stone abutments can likely be reused but require rehabilitation and widening to support the wider superstructure.

The construction staging of this bridge would follow the typical sequence for single existing track, single proposed track scenarios (see Alternatives Description Section 4.3). During the first stage, a portion of the new steel tub superstructure must be constructed adjacent to the existing timber stringer structure, maintaining horizontal clearance as necessary for erection and safe rail operation. This would require that the final superstructure be wide enough to support the stage one track alignment as well as the final track alignment.

2.2.9 Brownell Street (M.P. 51.03)

The bridge over Brownell Street is a single-span thru girder structure with an open deck. The structure consists of two bays, but only the west bay currently carries active track.

The bridge requires reconstruction as it does not rate for Cooper E80 loading and provides inadequate horizontal clearance. The proposed structure is envisioned to be a single-span ballasted steel tub superstructure carrying a single track. The existing stone masonry abutments can likely be reused but would require rehabilitation to accommodate the increased loads, as well as some geometric modifications to the backwalls and bearing areas.

The construction staging of this bridge would follow the typical sequence for single existing track, single proposed track scenarios (see Alternatives Description Section 4.3). During the first stage, a portion of the new steel tub superstructure must be constructed adjacent to the existing thru girder structure, maintaining horizontal clearance as necessary for erection and safe rail operation. This would require that the final superstructure be wide enough to support the stage one track alignment as well as the final track alignment.

2.2.10 President's Avenue (M.P. 51.11)

The bridge over President's Avenue is a two-span thru girder structure with an open deck and steel pier. The structure currently consists of two bays, but only the west bay currently carries active track. A third bay to the west has been removed.

The bridge requires reconstruction as it does not rate for Cooper E80 loading and provides inadequate horizontal clearance. The proposed structure is envisioned to be a single-span ballasted steel plate thru girder superstructure carrying a single track. The existing stone masonry abutments can likely be reused but would require rehabilitation to accommodate the increased loads, as well as some geometric modifications to the backwalls and bearing areas.

The construction staging of this bridge would follow the typical sequence for single existing track, single proposed track scenarios (see Alternatives Description Section 4.3). Move the active track to the eastern bay. Demolish the western bay and construct a new thru girder structure. Move the active track to the new structure in the western bay and demolish the eastern bay.

2.2.11 Pearce Street (M.P. 51.20)

The bridge over Pearce Street was recently reconstructed as part of an early action project. The bridge consists of a single-span ballasted steel tub superstructure carrying a single active track. The bridge originally consisted of two bays.

The bridge requires construction as there are currently two sets of tracks proposed over Pearce Street. The existing structure would be widened using the same ballasted steel tub construction as the existing structure. The existing stone masonry abutments were rehabilitated during previous construction, but may have to be modified to accommodate the additional width of the proposed superstructure.

The widening of the superstructure should be able to take place with minimal disturbance to rail traffic.

2.2.12 Turner Street (M.P. 51.40)

The bridge over Turner Street was recently reconstructed as part of an early action project. The bridge consists of a single-span ballasted steel tub superstructure carrying a single active track. The bridge originally consisted of three bays.

The bridge requires construction as there are currently two sets of tracks proposed over Pearce Street. The existing structure would be widened using the same ballasted steel tub construction as the existing structure. The existing stone masonry abutments were rehabilitated during previous construction, but may have to be modified to accommodate the additional width of the proposed superstructure.

The widening of the superstructure should be able to take place with minimal disturbance to rail traffic.

2.2.13 Channel near Battleship Cove (M.P. 52.38)

The bridge over the channel near the proposed Battleship Cove Station is a three-bay single span open deck timber girder structure currently carrying a single in-active track. The east and west bays are abandoned with the rails partially removed.

As this bridge lies just south of the platform at the proposed Battleship Cove Station, it is currently assumed that the bridge would be reconstructed to carry a single track. Further investigation is required to evaluate the preferred structure type as the current structure would be need to be replaced to carry any service.

Construction on this bridge can proceed unimpeded, as there is currently no active rail within the limits of work.

3 Stoughton Line Bridges

3.1 No Work Bridges

The following is a list of bridge crossings (both undergrade and overhead) that would not require rehabilitation or reconstruction as part of the currently envisioned South Coast Rail project:

- Revere Street (M.P. 15.21) – Undergrade
- I-495 (M.P. 30.48) – Overhead
- Summer Street (M.P. 34.80) – Overhead
- High Street (M.P. 35.00) - Overhead

3.2 Bridges Requiring Rehabilitation or Reconstruction

The following is a list of bridge crossings (both undergrade and overhead) that require rehabilitation or reconstruction as part of the currently envisioned South Coast Rail project:

3.2.1 Forge Pond (M.P. 15.79)

The bridge over Forge Pond is a single-span structure consisting of two earth filled arches adjacent to each other. The east arch is constructed of ashlar stone masonry and the west arch is a composite of a concrete ring at the bottom and a stone masonry ring on the top. The structure currently carries one active track.

The existing arch structure appears in relatively good condition, but its load carrying capabilities, especially with the loading of two sets of tracks as proposed, are unknown. The arch structure is historically significant. The proposed structure is envisioned to be a ballasted precast, prestressed concrete superstructure, supported by augered piles or drilled shafts. The intent is to span over the existing arch with the proposed superstructure, preventing loads from being transferred to the arch.

The construction staging of this bridge would follow the typical sequence for single existing track, two proposed track scenarios (see Alternatives Description Section 4.3). The first half of the superstructure would be constructed over the arch at the proposed raised profile grade. After rail traffic has been diverted to the new bridge, the profile can be raised for the remainder of the rail bed and bridge construction can be completed. The superstructure would be transversely post-tensioned after each stage of new construction to ensure adequate distribution of structural live loads.

3.2.2 Bolivar Street (M.P. 16.11)

The bridge over Bolivar Street is a single-span thru girder structure with an open deck. The structure originally supported two sets of tracks, but currently consists of only a single superstructure bay, carrying active rail.

The bridge requires reconstruction as it does not rate for Cooper E80 loading and does not provide adequate vertical clearance over the roadway below. The proposed structure is envisioned to be a ballasted steel tub superstructure carrying two sets of tracks. The existing stacked stone abutments can likely be partially reused but would require rehabilitation to accommodate the increased loads, as well as some geometric modifications to the backwalls and bearing areas.

The construction staging of this bridge would follow the typical sequence for single existing track, two proposed track, scenarios (see Alternatives Description Section 4.3). During the first stage, a portion of the new steel tub superstructure would be constructed adjacent to the existing thru girder structure while providing adequate horizontal clearance for erection and safe rail operation. This would require that the final superstructure be designed wide enough to accommodate the stage one track alignment as well as the final track alignments.

3.2.3 Mill Brook (M.P. 16.56)

The bridge over Mill Brook is a single-span, earth filled, ashlar stone masonry arch structure. The structure currently carries one active track.

The existing arch structure appears in relatively good condition, but its load carrying capabilities, especially with the loading of two sets of tracks as proposed, are unknown. The arch structure is historically significant. The proposed structure is envisioned to be a ballasted precast, prestressed concrete superstructure, supported by augered piles or drilled shafts. The intent is to span over the existing arch with the proposed superstructure, preventing loads from being transferred to the arch.

The construction staging of this bridge would follow the typical sequence for single existing track, two proposed track scenarios (see Alternatives Description Section 4.3). The first half of the superstructure would be constructed over the arch at the proposed raised profile grade. After rail traffic has been diverted to the new bridge, the profile can be raised for the remainder of the rail bed and bridge construction can be completed.

3.2.4 Coal Yard Road (M.P. 19.07)

The bridge over Coal Yard Road is a single-span multiple steel stringer structure with an open deck. The structure originally supported three superstructure bays, but the easternmost bay has been removed. The remaining bays both carry active rail.

The bridge requires reconstruction as it does not rate for Cooper E80 loading. The proposed structure is envisioned to be a ballasted precast box girder superstructure carrying two sets of tracks. The existing stacked stone abutments can likely be reused but would require rehabilitation to accommodate the increased loads, as well as some geometric modifications to the backwalls and bearing areas.

The construction staging of this bridge would follow the typical sequence for two existing track, two proposed track scenarios (see Alternatives Description Section 4.3). The superstructure would be transversely post-tensioned after each stage of new construction to ensure adequate distribution of structural live loads.

3.2.5 Totman Farm Road (M.P. 20.85)

The bridge over Totman Farm Road is no longer in service and had its superstructure removed approximately 15 years ago. Only portions of the existing stacked stone abutments remain.

The proposed structure is envisioned to be a ballasted steel tub superstructure carrying two sets of tracks. New cast-in-place concrete abutments are likely to be required, due to the current condition of the existing abutments.

Construction on this bridge can proceed unimpeded as there is currently no active rail within the limits of work.

3.2.6 Day's Farm Road (M.P. 21.57)

The bridge over Day's Farm Road is a single-span stringer structure with an open deck. The bridge carries a single inactive track.

The bridge requires reconstruction as it does not rate for Cooper E80 loading. The proposed structure is envisioned to be a ballasted steel tub superstructure carrying two sets of tracks. The existing stacked stone abutments can likely be reused but would require rehabilitation to accommodate the increased loads, as well as some geometric modifications to the backwalls and bearing areas.

Construction on this bridge can proceed unimpeded as there is currently no active rail within the limits of work.

3.2.7 Cowessett Brook (M.P. 21.75)

The bridge over Cowessett Brook is a single-span steel stringer structure with an open deck. The single bay does not currently carry active track.

The bridge requires reconstruction as it does not rate for Cooper E80 loading. The proposed structure is envisioned to be a ballasted steel tub superstructure carrying two sets of tracks. New abutments would be constructed behind the existing abutments, increasing the span length. The existing abutments would be partially removed to an elevation equal to the brook's average seasonal high water elevation. The space between the existing and proposed abutments would be graded to reconnect the stream banks on either side of the bridge.

Construction on this bridge could proceed unimpeded, as there is currently no active rail within the limits of work.

3.2.8 Pond Street (M.P. 22.80)

The bridge over Ames Street is a single-span thru girder structure with an open deck. Two independent and identical superstructures each carry one inactive track.

The bridge requires reconstruction as it does not rate for Cooper E80 loading. The proposed structure is envisioned to be a ballasted steel tub superstructure carrying one track. The existing stacked stone abutments can likely be reused but would require rehabilitation to accommodate the increased loads, as well as some geometric modifications to the backwalls and bearing areas.

Construction on this bridge can proceed unimpeded as there is currently no active rail within the limits of work.

3.2.9 Small Creek (M.P. 22.84)

The bridge over Small Creek is a single-span steel stringer structure with an open deck. Two independent superstructures carry one inactive track each and are supported by common, stacked stone, abutments.

The bridge requires reconstruction as it does not rate for Cooper E80 loading. The proposed structure is envisioned to be a ballasted precast box girder superstructure carrying one track. The existing stacked stone abutments can likely be reused but would require rehabilitation to accommodate the increased loads, as well as some geometric modifications to the backwalls and bearing areas.

Construction on this bridge can proceed unimpeded as there is currently no active rail within the limits of work.

3.2.10 Main Street (M.P. 22.93)

The Main Street Bridge over the railroad right of way has been filled in. The retaining walls in the depressed corridor leading to the bridge were left in place, and it is assumed that the bridge abutments were left in place as well. The bridge is located within the Town of Easton's Historic District.

Given the current existing roadway and railroad profiles, vertical clearances would not be adequate under the bridge. In order to provide adequate vertical clearance, the railroad profile would need to be lowered and the roadway profile would need to be raised. This increase in the roadway profile would be designed to minimize any potential negative impacts to historical resources. It is anticipated that new abutments would be required. They would be located to minimize the bridge's clear span, minimizing the required structure depth. Depending on how deep the railroad profile must be lowered, new retaining walls may need to be constructed in front of the existing walls to achieve the required grades. A type study would be required to determine the preferred bridge type. The bridge would be a single-span over one track.

3.2.11 Bridge Street (M.P. 23.27)

The Bridge Street bridge over the railroad right of way has been filled in.

A type study would be required to determine a preferred structure type. The construction of the bridge would require staging if traffic is to be maintained on the roadway.

The construction staging of this bridge would follow the typical sequence for roadway bridges (see Alternatives Description Section 4.3).

3.2.12 Hockomock Swamp Trestle (M.P. 26.17)

The Hockomock Swamp trestle would start at approx. STA 1425+00, end at approx. STA 1510+00 and consist of a multi-span, ballasted superstructure supported by deep foundations.

The construction of the proposed trestle through the Hockomock Swamp ACEC is detailed in the Hockomock Swamp Trestle "FEIS/FEIR Technical Report".

3.2.13 Bridge Street (M.P. 30.20)

The Bridge Street bridge over the railroad right of way is a single-span structure of unknown type.

The bridge requires reconstruction as it does not provide the required horizontal clearance to accommodate two sets of tracks underneath, as proposed. A full type study would be required to properly determine a preferred structure type.

3.2.14 Route 138 Grade Separation (M.P. 31.31)

When in service, the intersection at Route 138 was a grade crossing. There is currently no rail through the intersection.

At Route 138, the proposed treatment of the intersection is to create a grade separation, depressing the track profile as required provide adequate vertical clearance under the bridge. This would improve safety and reduce traffic congestion. The lowering of the profile would require construction of retaining walls leading up to the structure on both sides. A full type study would be required to properly determine a preferred structure type. The construction of the bridge would be staged as to maintain traffic and to minimize impacts to abutters.

3.2.15 Thrasher Street (M.P. 33.33)

The Thrasher Street Bridge over the railroad right of way has been filled in. It is unknown whether the existing abutments or any retaining walls remain in place.

A type study would be required to determine the preferred structure type. The construction of the bridge would require staging if traffic is to be maintained on the roadway. The bridge would span over one track.

3.2.16 Construction Sequencing of Taunton River and Mill River Bridges:

The reconstruction of the Taunton River and Mill River bridges are complex in that they are located within an environmentally sensitive area, are not readily accessible by roadway, and are generally long span bridges. It is assumed that the track would be deactivated, as necessary, from Dean Street to Weir Junction, which would allow unimpeded construction along this segment of rail. Access to the bridges on the Taunton River would be accomplished with a combination of rail-mounted and barge-mounted cranes, as well the utilization of roadway access from Dean Street and Summer Street. The following paragraphs describe the general construction methods and sequencing that would be used to construct the bridges:

1. Install Erosion Controls and Selective Trimming of Vegetation: Erosion controls (staked, embedded siltation fencing and/or hay bales) would be installed along the river banks at both ends of the bridges. Vegetation within the limit of work would be cleared and tree branches trimmed to prepare the work areas. Any remaining ties or rail would be removed and disposed of in accordance with Massachusetts regulations.

2. Relocation of Existing Water Main: A 20-inch insulated water main is currently supported on the southern side of the bridges. The water main travels parallel to the existing railroad bed across all three Taunton river bridges and the Mill river bridge as well. This water main would need to be temporarily relocated prior to the demolition of the existing bridges. It is envisioned that the water main would be supported during construction operations by means of temporary utility bridges, located within close proximity to the railroad bridges. This would allow unfettered access to the bridges during construction, while minimizing disturbances to the water supply.

3. Demolition of Existing Bridges: The existing bridge superstructures would be completely removed and the existing steel h-pile foundations would be partially removed to approx. two feet below the river's mud line elevation.

4. New Bridge Substructure: The 2-span bridges are envisioned to be supported by deep foundations, i.e. steel h-piles or drilled shafts.

Installation of the deep foundation system would occur at both abutments and the center pier. It is anticipated that a cofferdam would be required to install the pile foundations and to construct the cast-in-place concrete center pier in the dry. The bridge abutments would be constructed and the existing abutments would be partially removed.

5. New Bridge Superstructure: The bridge superstructures are envisioned to consist of welded steel plate girders, arranged in a thru-girder configuration. The girders would be delivered to the bridge sites via barges and installed onto the bridge foundations. The deck beams and ballast plates wound then be installed.

6. Install New Ballast and Track: After placement of the steel ballast plates, installation of ballast and rail can commence in conjunction with off-bridge rail installation.

7. Relocation of Existing Water Main: In conjunction with the installation of ballast and rail, the existing water main would be relocated onto the new bridge superstructures. At this time, the temporary utility bridges would be permanently removed.

3.2.17 Taunton River (M.P. 34.38)

The bridge over the Taunton River at M.P. 34.38 is an open deck steel trestle structure consisting of one main span with three approach spans to the North and seven approach spans to the South. The main span consists of two steel plate girders. The approach spans consist of timber stringers. The girders and beams are supported on steel bents with HP piles. The bridge carries one active track.

The bridge requires reconstruction as it does not rate for Cooper E80 loading. The proposed structure is envisioned to be a two-span, ballasted steel thru girder superstructure carrying a single track. The existing piles would be removed to two feet below grade and a new, pile supported, cast-in-place concrete pier would be constructed in the center of the span. New cast-in-place concrete abutments would be constructed behind the existing timber crib abutments, increasing the span length of the bridge. The existing abutments would then be partially removed to an elevation equal to the river's average seasonal high water elevation. The space between the existing and proposed abutments would be regraded to recreate the river banks on either side of the bridge.

3.2.18 Taunton River (M.P. 34.62)

The bridge over the Taunton River is an open deck trestle structure consisting of one main span with nine approach spans to the North and six approach spans to the South. The main span consists of two steel plate girders. The approach spans consist of timber stringers. The girders and beams are supported on steel bents with HP piles. The bridge carries one active track.

The bridge requires reconstruction as it does not rate for Cooper E80 loading. The proposed structure is envisioned to be a two-span, ballasted steel thru girder superstructure carrying a single track. The pile would be removed to two feet below grade and a cast-in-place concrete pier would be constructed in the center of the span. New cast-in-place concrete abutments would be constructed behind the existing timber crib abutments, increasing the span length. The existing abutments would be partially removed to an elevation equal to the river's average seasonal high water elevation. The space between the existing and proposed abutments would be graded to recreate the stream banks on either side of the bridge.

3.2.19 Taunton River (M.P. 34.73)

The bridge over the Taunton River is an open deck trestle structure consisting of 17 spans spaced variably. The spans consist of two timber stringers supporting a timber deck. The longitudinal beams are supported on steel bents with HP piles. The bridge carries one active track.

The bridge requires reconstruction as it does not rate for Cooper E80 loading. The proposed structure is envisioned to be a two-span, ballasted steel thru girder superstructure carrying a single track. The piles would be removed to two feet below grade and a cast-in-place concrete pier would be constructed in the center of the span. New cast-in-place concrete abutments would be constructed behind the existing timber crib abutments, increasing the span length. The existing abutments would be partially removed to an elevation equal to the river's average seasonal high water elevation. The space between the existing and proposed abutments would be graded to recreate the stream banks on either side of the bridge.

3.2.20 Mill River (M.P. 34.90)

The bridge over the Mill River is a single-span steel plate girder structure carrying a single active track.

The bridge requires reconstruction as it does not rate for Cooper E80 loading. The proposed structure is envisioned to be a single-span, ballasted steel tub superstructure carrying a single track. New cast-in-place concrete abutments would be constructed behind the existing abutments, increasing the span length. The existing abutments would be partially removed to an elevation equal to the river's average seasonal high water elevation. The space between the existing and proposed abutments would be graded to reconnect the stream banks on either side of the bridge.

4 Whittenton Branch Bridges

4.1 No Work Bridges

There are no bridges (both undergrade and overhead) that do not require rehabilitation or reconstruction as part of the currently envisioned South Coast Rail project:

4.2 Bridges Requiring Rehabilitation or Reconstruction

The following sections describe the bridge crossings (both undergrade and overhead) that require rehabilitation or reconstruction as part of the currently envisioned South Coast Rail project.

4.2.1 King Phillip Street (M.P. 32.16)

The bridge over King Phillip Street is no longer in service and its superstructure was removed at some point in the past. The full height existing granite block masonry abutment and wingwalls are still in place and are set right at the edge of the roadway.

The existing roadway width between the abutments is 20 feet, and there are no sidewalks. The height from the roadway to the existing abutment bridge seat is 11′-0″. This bridge requires complete replacement, because the existing abutment configuration does not provide adequate lateral or vertical clearance.

There are two options for the single track single span superstructure types that are dependent on the selection of the new abutment types.

> Option 1: A 47′-7″ span with full height concrete abutments, a ballasted steel tub girder superstructure with 4 - 32″ deep girders and a total structure depth of 5′-4″.
>
> Option 2: A 100′-9″ span with concrete stub abutments, a ballasted steel through girder superstructure with 2 – 7′-6″ deep through girders and a total structure depth of 4′-7″.

The roadway will be widened to meet current standards for local roads and to include a sidewalk, and the clearance will be increased from 11′-0″ to 14′-6″. Construction on this bridge can proceed unimpeded as there is currently no active rail within the limits of work.

4.2.2 Bay Street (31.58)

The bridge carrying Bay Street over the Railroad right-of-way has been removed and filled in. It is unclear whether any substructure remains, although there are no visible signs of existing abutments or retaining walls. The new bridge will maintain the existing lane configuration for Bay Street, with two traffic lanes and two sidewalks over a single track.

It is anticipated that the new rail profile will need to be set from 4 to 5 feet below existing grade in order to achieve a minimum vertical clearance of 18′-6″. This will likely require some low retaining walls along the railroad approaches. The MBTA preferred minimum lateral clearance to continuous obstructions is 12′-0″. Using a 24′-0″ overall lateral clearance, two different span lengths are feasible.

> Option 1: A 29′-3″ span with full height concrete abutments aligned with the approach retaining walls. The minimum structure depth for this span length would be approximately 2 feet ′ for a concrete deck on steel stringers.
>
> Option 2: A 63′-7″ span with concrete stub abutments set at the limits of the right-of-way, behind the short railroad retaining walls. The minimum structure depth for this span length would be approximately 3 feet for a concrete deck on steel stringers.

Construction on this bridge can proceed unimpeded as there is currently no active rail within the limits of work. The bridge would be constructed in phases to maintain alternating one way traffic.

4.2.3 Mill River (M.P. 32.16)

The existing bridge is a seven-span concrete slab bridge carrying the Railroad right-of-way over the Mill River. The bridge had been converted to a trail bridge and is currently closed due to severe deterioration of the piers. The existing structure is roughly 100 feet long with a skewed concrete west abutment and square stone east abutment. Some of the concrete piers are severely deteriorated. The structure requires complete replacement due to the condition of the substructure and insufficient load capacity of the superstructure.

The abutments for the proposed structure will be set behind the existing abutments, resulting in a span length of roughly 120 feet. The river banks would be restored in front of the new abutments. As the six existing piers will be removed, it is assumed that a single pier located within the river is acceptable. This would result in a two-span structure with each span length around 60 feet. The existing piers and east abutment are square to the right-of-way at a slight bend in the river. All proposed substructure elements will be skewed at roughly 25 degrees to closely match the alignment of the river at the bridge location. The bottom of proposed structure will match the bottom of existing in order to maintain the hydraulic opening. The existing structure is approximately 3′-6″ deep on the northern fascia and 4′-10″ deep on the southern fascia due to the curvature of the right-of-way. According to FEMA data, the 100-year flood elevation at this location is around elevation 51.4, approximately 3 feet below the proposed bottom of structure.

Two superstructure types are suitable for the possible span configurations:

> Option 1: A 120-foot single span with concrete stub abutments. This span length would require a ballasted deck steel thru girder structure with an approximate top of rail to bottom of structure depth of 5′-5″.
>
> Option 2: Two 60-foot spans with concrete stub abutments and a concrete center pier located within the river. For this alternative, a ballasted deck steel tub girder section could be used with an approximate top of rail to bottom of structure depth of 5′-10″. A steel thru girder structure could be used for this span configuration as well, with an approximate top of rail to bottom of structure depth of 5′-5″. The tub girder structure would be preferable to the thru girder as the thru girders are not structurally redundant and do not allow flexibility to realign the track or widen the bridge in the future.

Demolition of the existing structure and construction of the new railroad bridge can proceed unimpeded as there is currently no active rail within the limits of work.

Appendix 3.2-C

Hockomock Trestle Memorandum

Transportation
Land Development
Environmental
Services

VHB *Vanasse Hangen Brustlin, Inc.*

99 High Street
Boston, Massachusetts 02110
617 728-7777
FAX 617 728-7782

Memorandum

To: File

Date: May 10, 2012

Project No.: 10111

From: Kristofer Kretsch, P.E.

Re: South Coast Rail
Hockomock Swamp Trestle

EXECUTIVE SUMMARY

This document specifically responds to the requirements of the Secretary's Certificate on the DEIR which states: "The FEIR should evaluate the engineering feasibility of constructing the proposed trestle in wetland soils … The FEIR should also discuss how access will be achieved for any maintenance or emergency situations along portions of the rail ROW, including sections of the rail located in the Hockomock and Pine Swamps." This report summarizes the concepts evaluated for constructing a trestle structure through the Hockomock Swamp between Foundry Street (MP 11.8) in Easton, MA and Race track Crossing (MP 14.10) in Raynham, MA. The proposed trestle is to be constructed through the swamp on the existing MBTA right-of way. Consideration of the trestle type and materials included evaluation to impacts to the sensitive areas adjacent to the right-of-way as well as construction cost and maintenance.

A subsurface soil exploration was performed as part of the evaluation to identify appropriate foundation types. Driven steel H-piles are suitable to the site, and steel pile pier bents are recommended to minimize impacts associated with excavation and hauling.

The superstructure types considered consisted of common steel and concrete structures and prefabricated concrete arch units. Steel deck beam and through girders and prestressed concrete box beams and Northeast Extreme (NEXT) beams were evaluated for cost, ease of construction and maintenance. Consideration was also given to maximizing span lengths to minimize the number of piers to be constructed. Prestressed concrete boxes were found to be the most cost effective, offered a range of workable span lengths, and require the least amount of maintenance. Steel structures offer longer span lengths, but they are more costly and require more maintenance. The concrete arch option is more costly than the prestressed beams, and physical limitations with the arch design would require the trestle to be constructed at an excessively higher elevation than the other alternatives resulting in more impacts associated with constructing longer approaches.

Additional consideration was given to prefabricated superstructure and substructure elements. Using prefabricated elements reduces construction time and impact associated with forming, trucking and placing cast-in-place concrete.

Access for construction would be from the north at Foundry Street and from the south from Race track Crossing. Construction of the trestle would require equipment working at grade within the right-of-way as the piles are installed. As the superstructure is erected, all work can be completed with equipment working from the superstructure as it is installed.

INTRODUCTION

Purpose of This Technical Report

This technical report was prepared to address the requirements of the Secretary's Certificate on the Draft Environmental Impact Report concerning the design, construction, and operations of the proposed Hockomock Swamp trestle.

Requirements of the Secretary's Certificate

The Certificate required that the Final Environmental Impact Report specifically address the impacts of the trestle related to infrastructure, access roads, construction, and on-going maintenance.

Comments on the DEIS/DEIR

Other comments on the DEIS/DEIR related to the Hockomock Trestle concerned engineering and construction methods, the design of the trestle, the relationship of subsurface soil conditions to the design, and the feasibility and cost of construction. In addition, commentors were concerned with the width of canopy clearing, on-going vegetation management, and emergency access.

TRESTLE DESIGN AND CONSTRUCTION

Soil Conditions

A subsurface exploration program was conducted by Jacobs Engineering Group, Inc. in February 2012 for the purposes of providing preliminary geotechnical recommendations for the trestle structure. Jacobs issued a design geotechnical memorandum presenting the findings of the program and resulting foundation recommendations. As part of the program, nine borings were drilled along the proposed trestle alignment, with an additional three borings drilled along the approaches.

The subsurface conditions encountered generally consisted of a layer of granular fill with thickness of about 0 to 3 feet, underlain by natural, loose to dense stratified silt and sand deposits, and very dense glacial till. A thin 2 to 7-foot thick layer of organic silt was encountered in the upper 5 to 10 feet of soil in almost all of the trestle borings. The top of bedrock was typically encountered at depths ranging from 39 to 66.5 feet depth along the trestle borings. Groundwater level readings at termination of drilling were consistently at 3.5 to 6 feet depth along the trestle borings.

Various alternatives were investigated to support the trestle foundations. Preliminary foundation type selection took into account soil conditions and shear strength of near surface soils, and depth to bedrock. Spread footing foundations were discounted due to the loose to medium dense strength consistency of the upper overburden soils. Due to the high groundwater level and variable depth to bedrock, it does not appear that drilled shafts are a cost effective alternative compared to driven piles. The proposed trestle bents are recommended to be founded on driven steel H-piles bearing on the underlying bedrock.

Trestle Design

As discussed above, the recommended foundation type for the trestle is driven steel H-piles bearing on the underlying bedrock. Jacobs' geotechnical memorandum recommends that two rows of piles be used at each pier, which results in a roughly 10-foot wide pier cap.

The structure would be approximately 20 feet wide at single track locations to accommodate the track and walkway. The structure would be wider at one location (between stations 1462+00 and 1468+00) to accommodate a track turnout with a second parallel track to accommodate maintenance vehicles. Per MBTA requirements, the minimum lateral clearance from centerline of track to continuous obstruction is 8.5 feet, while the minimum lateral clearance between track centerlines at two-track locations is 13 feet. The structure would be 37 feet wide in this two-track section. In order to allow large mammal passage under the trestle, the minimum vertical clearance above the existing grade would be 5 feet.

Preliminary superstructure type selection took into account potential environmental impacts, construction cost, and overall constructability. The analysis assumed that the structure would have a ballasted deck and carry one track along the majority of the structure. The trestle would be designed to carry Cooper E-80 loading.

The trestle would need to accommodate catenary supports as well, which can be spaced at a maximum of 200 feet on center. The simplest way of supporting these poles would be at the pile cap, which would require that some piers be lengthened by 3 to 4 feet.

Precast or prefabricated elements are desirable for construction in the swamp to minimize impacts associated with forming, delivering and placing cast-in place concrete construction. Precast/prefabricated elements include pile caps, superstructure elements, deck slab panels and ballast retainers.

Several different superstructure alternatives were investigated for the trestle including prestressed concrete NEXT beams, adjacent prestressed concrete box beams, prestressed concrete arches, steel plate deck girders, and steel plate thru girders.

It is desirable to maximize span lengths in order to minimize the number of piers. Of the alternatives considered, steel plate girders and thru girders can be used to achieve the longest span lengths, but at significantly higher construction costs when compared to the concrete alternatives. The steel girders would also have much higher life cycle costs and possible future environmental impacts due to deterioration of the steel. Prestressed concrete box beams can achieve longer spans and are more cost effective than concrete NEXT beams or prestressed concrete arches. The box beams can be used for span lengths up to 50 feet.

Considering environmental impact, cost, and constructability, the recommended alternative is adjacent prestressed concrete box beams with 50-foot spans. The overall construction cost for this alternative is roughly $50,900,000.

Trestle Construction

Due to the sensitivity of the surrounding environment, construction methods should be used which minimize impacts outside the existing railroad bed. The construction activities would be performed within the constraints of a set boundary either side of the working area. This boundary would be defined by the installation of sedimentation and erosion controls along the existing railroad embankment.

The construction site can be accessed from the north through Foundry Street and from the south through Raynham Park. Raynham Park to the south is a likely candidate for a laydown area. To the north, there is a possible limited laydown area along the right-of-way, outside the limits of the swamp (adjacent to the Southeast Regional Vocational-Technical High School). Throughout construction, the site would be accessed only from the north and south ends, within the construction boundaries defined along the existing railroad right of way.

Construction Sequencing

Generally, the sequence of construction would utilize at least two crews per operation, working on the north and south halves of the trestle concurrently. Precast concrete elements including pile caps, deck slabs, and box beams can be utilized in order to expedite the construction process and minimize trucking and clean out areas associated with cast-in-place operations. The envisioned construction sequencing would consist of:

- Install erosion controls and selective trimming of vegetation
- Earthwork and construction of infiltration trenches
- Install piles and pile caps: Starting from the center of the Trestle and working back to

both ends, piles would be driven and pile caps installed by two separate work crews. Construction equipment would be working from existing grade within the erosion controls constructed at the right-of-way limits. Each crew would work from a separate laydown area on each end of the Trestle. In order to expedite the installation, the pile caps can be precast concrete, set on the piles and grouted into place. Each pile cap would be installed prior to the driving of piles at the next pier in order to avoid obstructing the movement of construction equipment on the embankment.

- Install trestle box girders: Once pile and pile cap construction is completed, the concrete box beams can be installed. This can also be done using two separate crews starting at both ends of the structure. Transverse post-tensioning of the box beams would be performed at this time to allow construction traffic access over the trestle. After the first span superstructure is erected, the beams in each subsequent span can be lifted in place using a crane located on top of the new structure.
- Install concrete deck: Once the box beams are installed, the contractor can install the concrete deck. This can be done either as the beam erection progresses, or once all beams of the trestle are erected. Precast deck panels may be used to expedite the process.
- Install ballast, track, signal cables, and power

The final step would be to install the ballast, track, signal cables, catenary wire and supports, and any ancillary items. The deck drain system would be installed prior to the ballast and linked to the infiltration trenches.

OPERATIONS AND MAINTENANCE

Access

Access for operations and maintenance would be from the trestle structure. There is a track turnout proposed on the superstructure for maintenance vehicles. Areas below the superstructure can be accessed from each of the piers with a ladder. There is no need for vehicular access at ground level.

Maintenance Activities

Routine maintenance for the trestle structure includes bi-annual bridge inspections in accordance with AREMA inspection guidelines, using ladders. All concrete and masonry structures and components should be given thorough, detailed inspections at scheduled intervals. A record of physical conditions should be kept. A special inspection may be required when the structure is subjected to abnormal conditions which may affect the capacity of the structure such as: floods, storms, fires, overloads and evidence of recent movement.

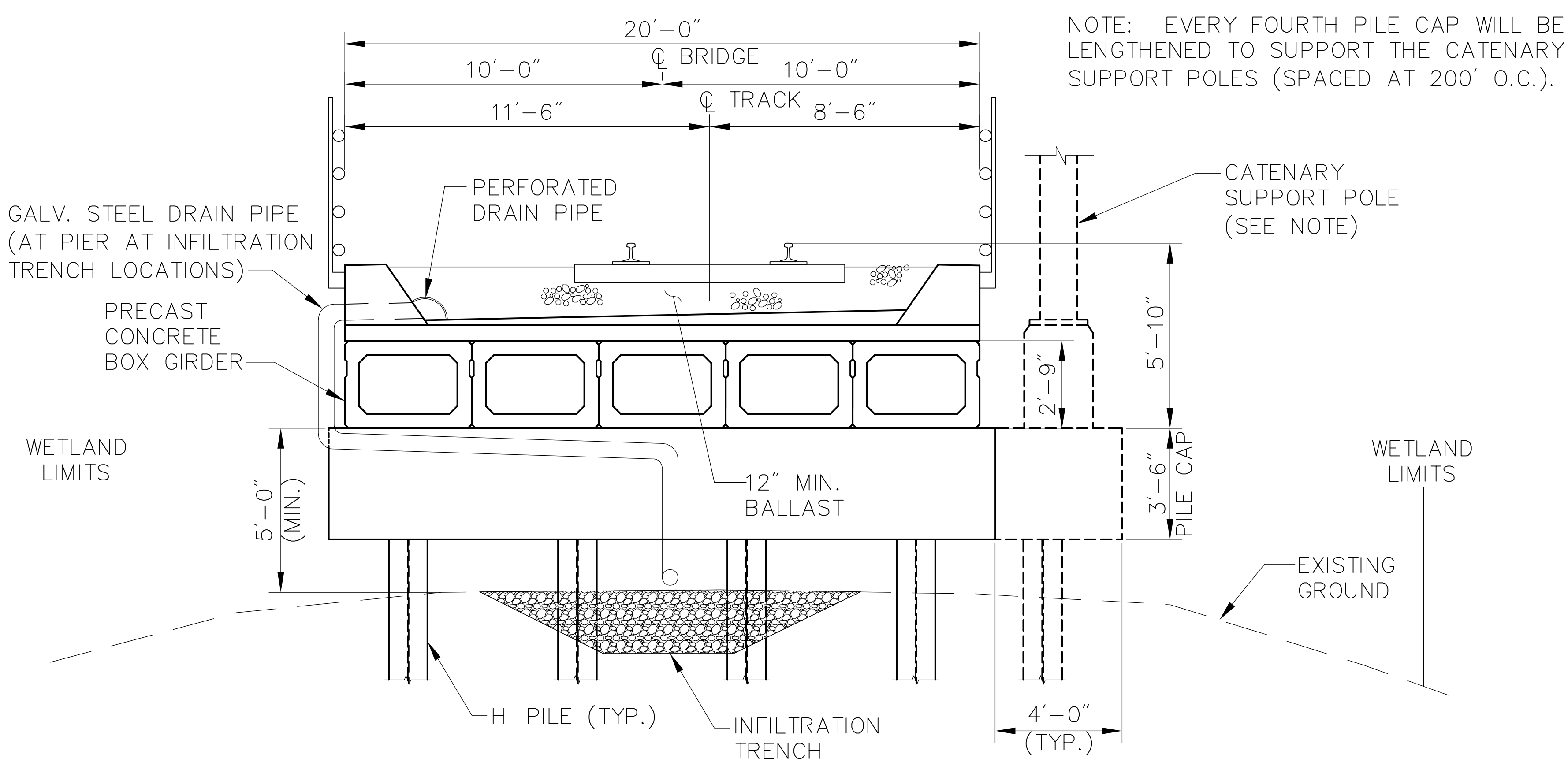
It is not anticipated that major equipment would be required. Long term maintenance to the trestle could consist of concrete repairs which would require working in localized, contained areas with small to moderate sized equipment working from the trestle. Maintenance of the track and ties and overhead catenary system would be done from the trestle.

Vegetation Management

The MBTA's program of annual vegetation maintenance on the ROW would control invasive species that may be established on the railbed or ballast. The Yearly Operating Plan for the Hockomock Swamp ACEC section of the track would be expanded to include a more specific protocol for the removal of invasive species. VMP staff would walk the track alignment on an annual basis, in July or August of each year and remove (pull) all individual plants of the invasive species listed above. Manual removal of invasive plants would be done within the railbed and within the adjacent wetlands or uplands, to a distance of 15 feet from the limit of clearing. An annual report would be prepared that documents the abundance and distribution of the species found. All removed invasive plant material would be placed in plastic bags and disposed of at a landfill. The VMP would be modified to prohibit the use of herbicide along the trestle and within the Hockomock Swamp.

Attachments

Figure 1: Trestle Through Hockomock Swamp – Typical Section
Figure 2: Trestle Through Hockomock Swamp – Typical Elevation
Figure 3: Trestle Through Hockomock Swamp – Construction Sequence



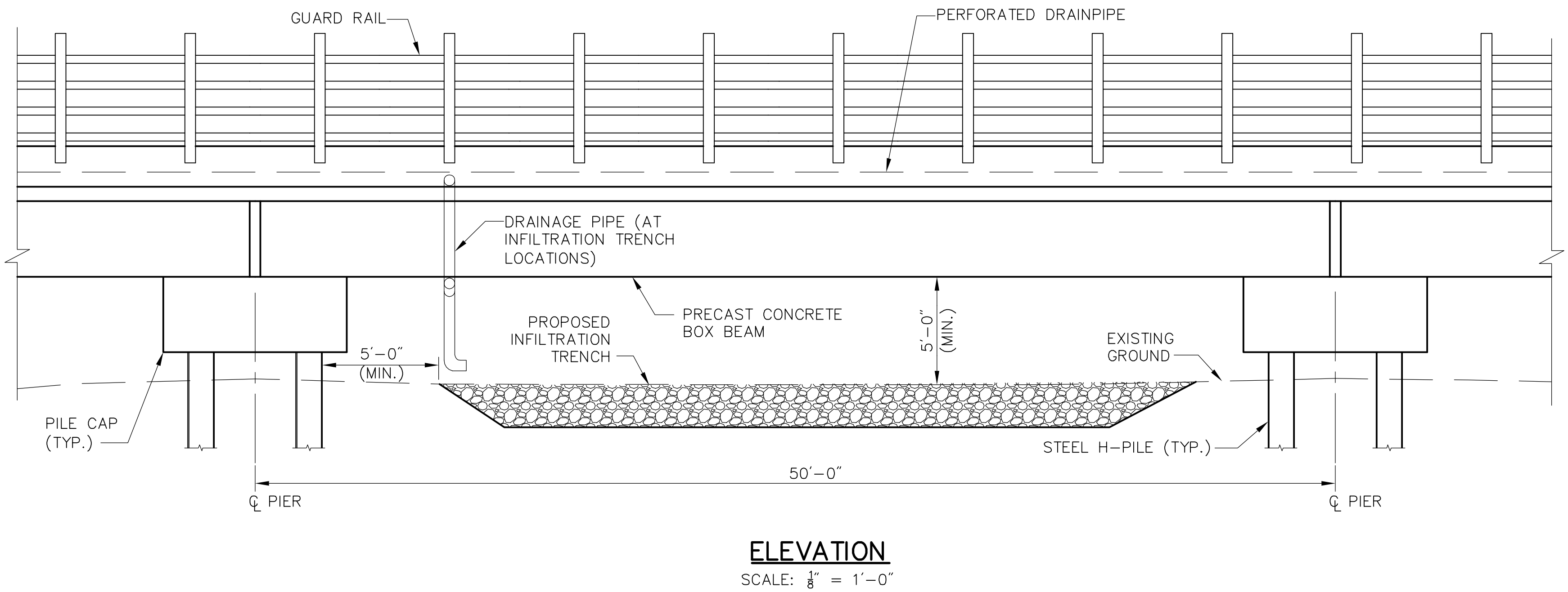
TYPICAL CROSS SECTION AT PIER

SCALE: 3/16" = 1–0'

FIGURE 1
TRESTLE THROUGH HOCKOMOCK SWAMP

TYPICAL SECTION

SOURCE
PREPAREDBY VHB

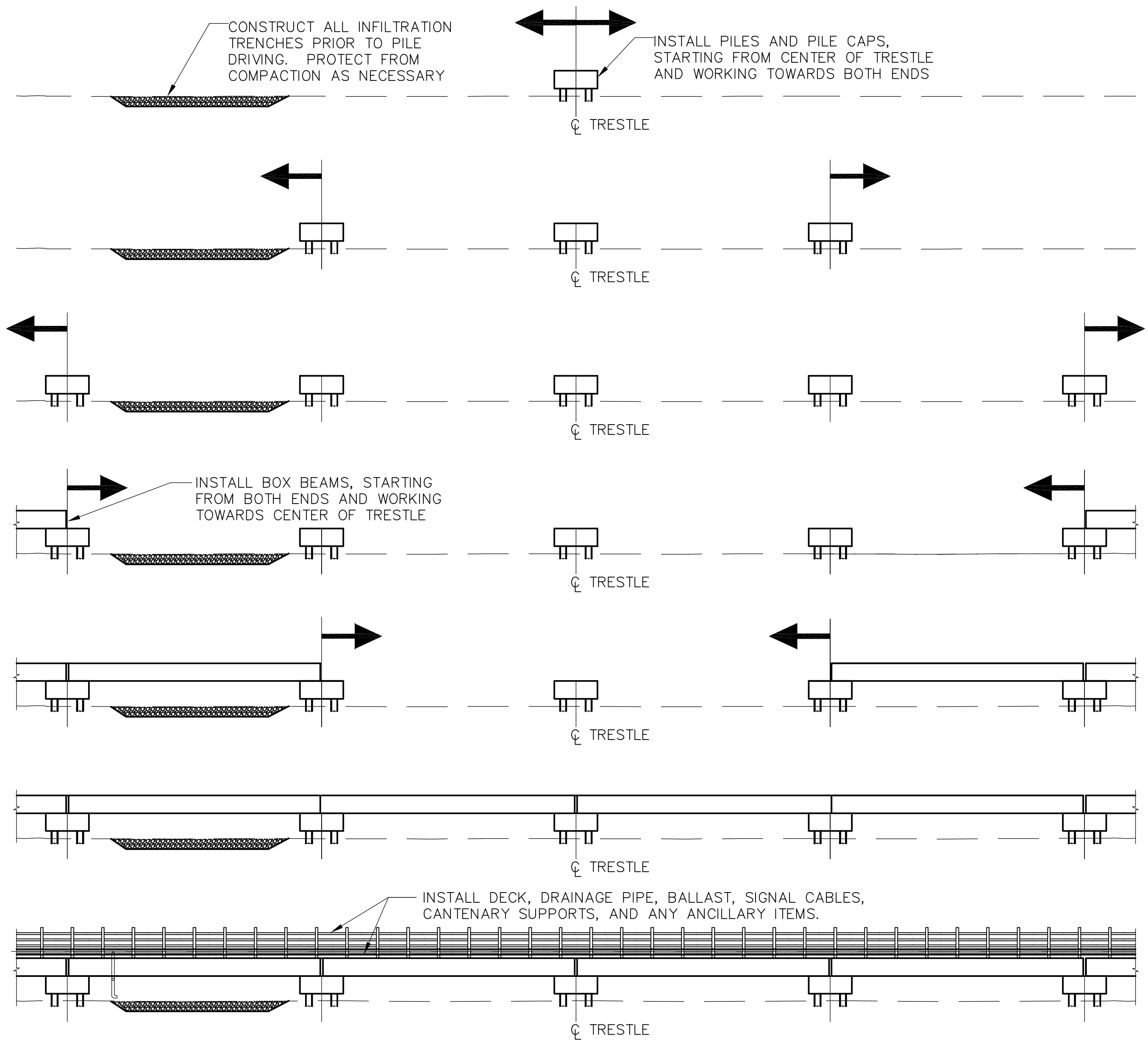


Moving Massachusetts Forward. massDOT

FIGURE 2
TRESTLE THROUGH HOCKOMOCK SWAMP

TYPICAL ELEVATION
SOURCE
PREPAREDBY VHB

\\MABOS\projects\10111.00\cad\st\study\Hockomock Trestle.dwg Printing Date: 5/10/2012 3:52 PM



CONSTRUCTION STAGING

SCALE: N.T.S.

FIGURE 3
TRESTLE THROUGH HOCKOMOCK SWAMP

CONSTRUCTION SEQUENCE
SOURCE
PREPAREDBY VHB

Appendix 3.2-D

Pine Swamp Trestle Memorandum

Transportation
Land Development
Environmental
Services

Vanasse Hangen Brustlin, Inc.

101 Walnut Street
P. O. Box 9151
Watertown, MA 02471-9151
617 924 1770
FAX 617 924 2286

Memorandum

To: File

Date: March 9, 2012

Project No.: 10111

From: Mark Louro
Lisa Standley

Re: South Coast Rail
Pine Swamp Trestle

The Secretary's Certificate on the DEIR stated that "The FEIR should … evaluate the feasibility of constructing a trestle through Pine Swamp". The current design for the Stoughton Alternative includes an at-grade track structure through the Pine Swamp, utilizing the existing embankment to carry the proposed track. This memorandum compares the current at-grade design through the Pine Swamp with a trestle option similar to the structure proposed for the Hockomock Swamp. As documented below, a trestle could be constructed through Pine Swamp but is not practicable based on cost, particularly when considered in the context of impacts to biological resources.

Pine Swamp

Pine Swamp is a 275-acre wetland system located in western Raynham and consisting of several properties that are owned by the Town of Raynham Conservation Commission. The Stoughton Line crosses the swamp in a one-mile segment from King Phillip Street to East Britannia Street (Figure 1). This area consists of forested and marsh wetlands known as Pine Swamp, an area that is located within estimated habitat of rare wetlands species, and which supports an Atlantic white cedar swamp community. Atlantic white cedar swamps do not support unique wildlife species, although some wetland species are more likely to occur in these coniferous wetlands than in red maple swamps. Ambystomid salamanders, four-toed salamanders, wood frogs, spring peepers, and spotted turtles are characteristic reptiles and amphibians (although none of these are restricted to Atlantic white cedar wetlands). In the 2001 wildlife surveys, VHB found four-toed salamanders and spotted turtles in Pine Swamp. Some bird species (red-shouldered hawk, barred owl, brown creeper, golden-crowned kinglet, northern and Louisiana waterthrush) are also characteristic of Atlantic white cedar swamps. There are no small mammals restricted to these wetlands, although red squirrels inhabit coniferous wetlands as well as uplands.

Pine Swamp is currently fragmented by the former railroad bed, which acts as a barrier to aquatic organisms except at the two culverts. The swamp is also fragmented by the Taunton Municipal Light Corporation's overhead powerline which is maintained as a cleared utility corridor.

In November 2011, the UMass Extension Center for Agriculture published two sets of town maps based on CAPS[1]. In conjunction with DEP, UMass produced Important Wildlife Habitat maps. In cooperation with MassDOT and the Federal Highway Administration (FHWA), UMass produced IEI maps showing the 50 percent of the landscape with the highest IEI values and color-coded by habitat type (forests, shrublands, freshwater wetlands and aquatic habitats). These maps show the existing conditions and are useful in visualizing the existing important biodiversity areas. In addition, these maps are useful in identifying areas where biodiversity mitigation may be of the most value. The DEP map, "Habitat of Potential Regional or Statewide Importance", shows important wildlife habitat ONLY on the west side of the ROW in Pine Swamp, indicating that there is not a compelling wildlife habitat connectivity across the ROW.

Pine Swamp is a small (relative to the Hockomock) wetland ecosystem that is not recognized as an ACEC or Important Bird Area. It does not have extensive vernal pool complexes adjacent to the existing elevated embankment or track bed, and does not support state-listed salamanders or turtles. The only state-listed species present is a butterfly (Hessel's hairstreak). The area immediately adjacent to the existing embankment is a power line where invasive species (*Phragmites*) have become established.

At-Grade Option

The existing embankment through the Pine Swamp extends 5,300 feet from King Philip Street to East Britannia Street. The top of the embankment varies from elevation 67 at King Philip Street, the northern limit, to elevation 58 at East Britannia Street, the southern limit. The At-Grade Option for the Pine Swamp section of the Stoughton Alternative, as presented in the DEIS/DEIR, was developed to minimize wetland impacts, particularly through the 3,300-foot section where the existing embankment is narrowest (the "limited width area").

The cross section currently proposed under the South Coast Rail Project for the limited width area utilizes layers of geogrid reinforcing to stabilize the 1:1 embankment and minimize wetland impacts. The proposed cross section (Figure 1) consists of the ballast layer running level one foot beyond the end of the tie where the slope breaks and slopes 2:1 to the bottom of the subballast layer at which point the side slope steepens to 1:1 by introducing a mechanically stabilized reinforced earth (MSRE) treatment using geogrid reinforcing between six-inch layers of compacted gravel fill. This solution offers a cost effective slope retention system that reduces the overall footprint of the proposed track bed structure by minimizing the embankment width to approximately 24 feet. This MSRE cross section does not include a three foot level walkway within the 3,300-foot limited width area as is proposed elsewhere. Also the MSRE treatment enables the proposed top of rail profile to remain one to three feet above the existing embankment, minimizing any visual barrier effect to wildlife.

The At-Grade Option would cost approximately $5 Million, and would result in filling approximately 15,600 square feet of wetland (Figures 3 and 4). Wildlife passage would be provided by reconstructing the two existing stream crossings with extended culverts (which provide a shelf or bank on either side of the waterway to allow a passage for non-aquatic wildlife), and by adding at least four wildlife underpasses. These wildlife underpasses will maintain travel passages for species that may be unable to cross the tracks (salamanders, frogs, turtles, small mammals) as well as

---

1 http://www.masscaps.org

enhance travel passages for small mammals that may be deterred from crossing an active rail line. Drift fences will be installed that will facilitate wildlife passage by directing movement to these underpasses.

Trestle Option

As required by the Secretary's Certificate, we have developed a trestle structure similar to the structure proposed for the Hockomock Swamp. It consists of two distinct cross sections – a 1,000-foot transition at each end and a central trestle structure, which is approximately 3,300 feet long. The transition (Figure 5) includes a cast-in-place (CIP) retained fill section that vertically transitions from the standard at-grade track cross section to the trestle at a grade of one percent. The retained fill section has an overall width of 28 to 30 feet. The cast-in-place retaining walls maintain a vertical barrier along each side of the track to minimize wetland impacts as the track profile rises up to the level of the trestle. The trestle (Figure 6) consists of a prestressed concrete superstructure. The overall width of the superstructure is 21 feet and is supported on pile caps that are spaced every 30 feet. The bottom of the superstructure is approximately three feet above the existing track bed to allow for inspection and maintenance, which translates to the top of rail profile rising up above the existing embankment as much as 9.5 feet. This solution reduces wetland impacts to only those locations where the pier caps and transition retaining walls extend into the bordering vegetated wetlands.

The design evaluated for Pine Swamp is the same as the trestle design for the Hockomock Swamp, because we assume that the same conditions exist in both locations. The railroad was built on fill placed over a swamp. Geotechnical borings from the Hockomock Swamp show a deep subsurface layer of peat over sand, silt and clay. Deep pilings are necessary to support the Cooper E-80 loadings required for the railroad. VHB and the geotechnical engineers at Jacobs have evaluated the data and conclude that the proposed pile-supported trestle is the most cost-effective structure in the Hockomock Swamp. It would therefore be the most cost-effective structure that meets the project loading requirements in Pine Swamp.

The superstructure types considered consisted of common steel and concrete structures, and prefabricated concrete arch units. Steel deck beam and through girders and prestressed concrete box beams and Northeast Extreme (NEXT) beams were evaluated for cost, ease of construction and maintenance. Consideration was also given to maximizing span lengths to minimize the number of piers to be constructed. Prestressed concrete boxes were found to be the most cost effective, offered a range of workable span lengths, and require the least amount of maintenance. Steel structures offer longer span lengths, but they are more costly, require more maintenance, and the advantage of longer span lengths is counter balanced by limited access to the trestle site. The concrete arch option is more costly than the prestressed beams, and physical limitations with the arch design require the trestle to be constructed at an excessively higher elevation than the other alternatives resulting in more impacts associated with constructing longer approaches. Based on the prestressed box beam type, the Trestle Option would cost approximately $50 Million, which includes engineering and construction costs. Other alternatives may be considered beyond the common bridge types, however it is not anticipated that any savings would be significant enough to make the trestle a viable option. This option would result in filling approximately 3,800 square feet of wetland (Figures 7 and 8).

Wildlife passage would be provided by the existing culverts (which do not have a shelf or bank on either side of the waterway to allow a passage for non-aquatic wildlife), and in the space under the trestle.

Taunton Municipal Power & Light Impacts

The Taunton Municipal Light Corporation (TMLC) currently uses the existing rail embankment for maintenance access of their overhead wires. A meeting was held with TMLC on February 16, 2012 (notes attached) to discuss the proposed track through the Pine Swamp and access requirements. TMLC annually inspects their wires and poles using the embankment for truck access for access. Once the track has been constructed they will be required to use a high-rail vehicle to perform this function A separate access road is not required and will not be constructed. With the At-Grade Option, the track will be less than three feet above the existing profile and the proposed embankment will allow access to each pole by foot and from a high-rail vehicle. TMLC may also relocate the line to Route 138 as another option.

Practicability

While each of the construction options offer a benefit to the project they appear to be on opposite ends of the spectrum regarding impacts and costs. The At-Grade MSRE solution provides a reasonable cost effective solution that retains and stabilizes the existing railroad track bed at a cost of less than $5 million and 15,600 square feet in wetland impacts, while maintaining wildlife passage. The At-Grade solution allows larger wildlife to cross over the tracks and provides wildlife passage for smaller animals through two enhanced culverts (reconstructed to meet Stream Crossing Standards, with upland shelves) and four additional between-the-ties wildlife passages. The Trestle Option has reduced impacts to wetlands (3,800 square feet) but at a cost of $50 million.

It is useful to compare Pine Swamp with the Hockomock Swamp to establish the justification for the extraordinary expense of an elevated trestle structure, at more than ten times the cost of at-grade rail. The South Coast Rail Project includes a 1.8-mile trestle through the Hockomock Swamp. The decision to elevate the track in the Hockomock Swamp was based on discussions with the Natural Heritage and Endangered Species Program staff during the prior MEPA process, and was an important mitigation commitment made in the 2002 FEIR and upheld by MassDOT in the current design for impacts on state-listed rare species.

The Hockomock Swamp is part of the Hockomock Swamp Area of Critical Environmental Concern (ACEC), which includes approximately 16,950 acres in Bridgewater, Easton, Norton, Raynham, Taunton, and West Bridgewater. In addition to its protection as an ACEC, portions of the swamp are also owned by MassWildlife as the Hockomock Swamp Wildlife Management Area, and it is designated as an Important Bird Area by the Massachusetts Audubon Society. The swamp is also designated as a Biomap Core Area by the NHESP, and is known to contain populations of several state-listed species.

A trestle was selected for the Hockomock Swamp section of the Stoughton Alternative, from Foundry Street to the Raynham Greyhound Park, to mitigate impacts of the South Coast Rail project on wetlands, rare species, vernal pools, and biological diversity. The Hockomock Swamp is a unique and highly valuable ecosystem, as indicated by its status as an Area of Critical Environmental Concern, Wildlife Management Area, Important Bird Area, and Biomap Core Habitat. The trestle, although it will increase project costs substantially, will allow vernal pool amphibians, state-listed rare salamanders and turtles, and other small vertebrates, to pass freely across the existing embankment through the swamp. Modifications to the embankment will allow passage of larger vertebrates.

While the Pine Swamp has conservation and biodiversity value, it is <u>not</u> a wildlife habitat for rare amphibians, a wildlife corridor, an ACEC or an IBA. The DEP Important Wildlife Habitat maps show that there is important wildlife habitat currently only on the west side of the ROW. Pine Swamp therefore does not have the extraordinary wildlife habitat value on both sides of the ROW that justifies the additional $45 million expenditure necessary to construct a trestle. The proposed MSRE stabilized track bed through the Pine Swamp along with other proposed mitigation including modifications to existing culverts and additional wildlife crossings provide a reasonable cost-effective solution to reduce the barrier effect resulting from replacing the former tracks that is in keeping with the biological diversity and overall value of the Pine Swamp.

Summary

Because Pine Swamp does not provide extraordinary biodiversity values, a trestle would not provide significant biodiversity or rare species benefits. The cost increase (ten times the cost of the At-Grade Alternative) is not warranted and the trestle is not practicable based on cost. Proposed wildlife crossing structures would mitigate for the effects of reconstructing the At-Grade Option, and the proposed MSRE treatment would minimize wetland impacts.

Attachments

Figure 1 – Pine Swamp Crossing
Figure 2 – MSRE Cross-Section
Figure 3 – MSRE, Northern Approach
Figure 4 – MSRE, Southern Approach
Figure 5 – Trestle Cross-Section, Transition
Figure 6 – Trestle Cross-Section
Figure 7 – Trestle Option, Northern Approach
Figure 8 – Trestle Option, Southern Approach

TMLC Meeting Notes

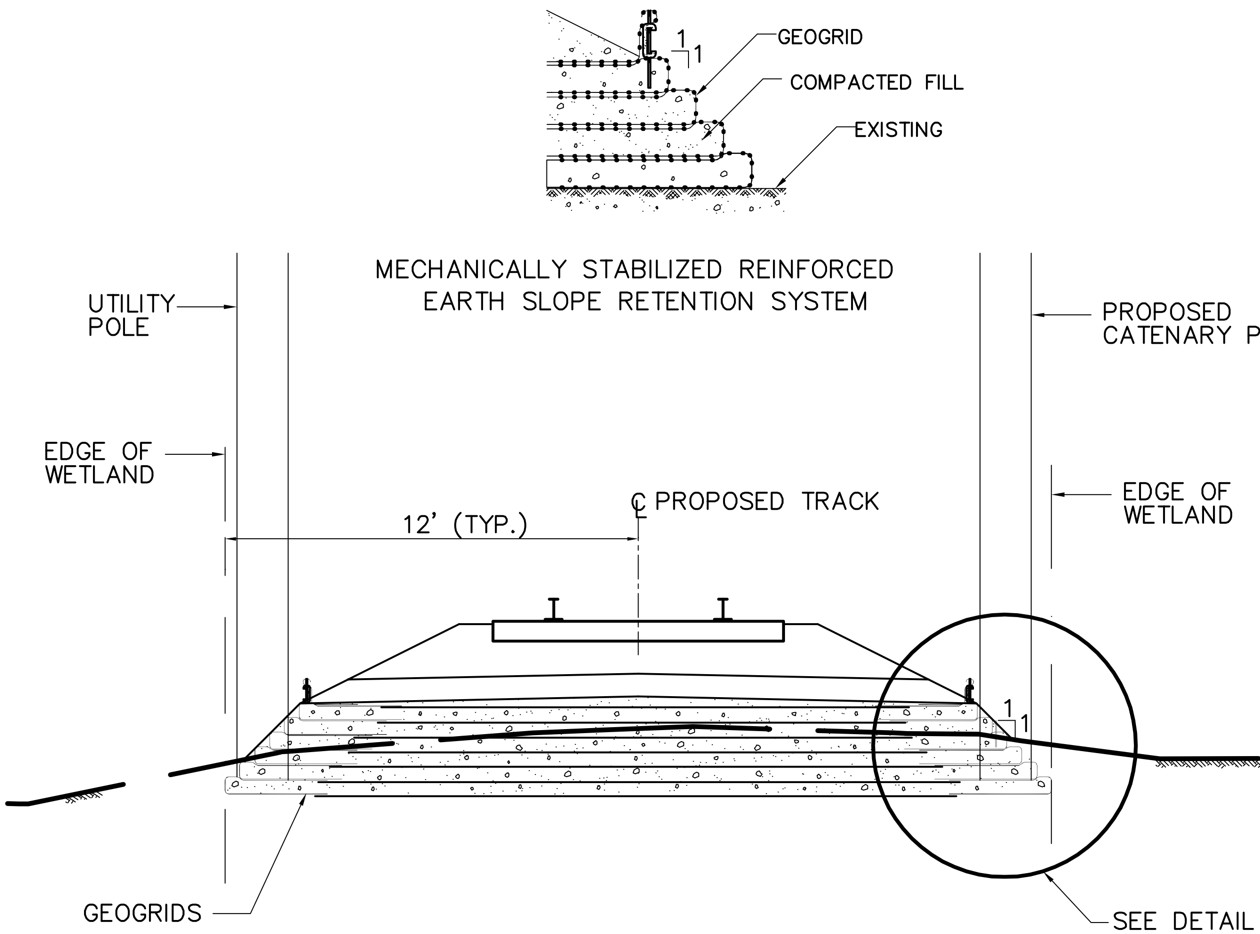
0 162.5 325 Feet

massDOT Moving Massachusetts Forward.

SOUTH COAST RAIL

Figure 1
Pine Swamp Crossing

Prepared by: VHB

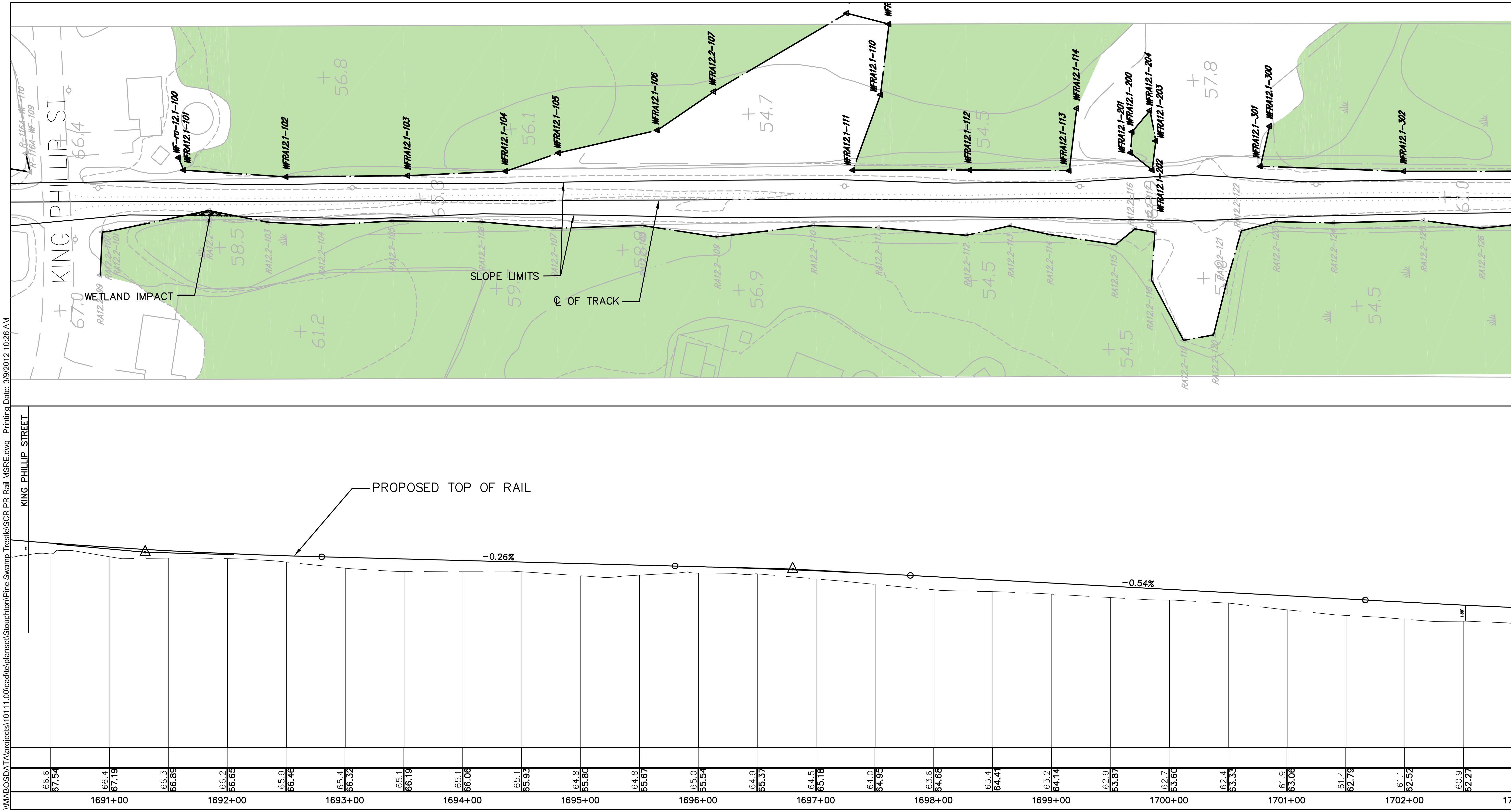


Moving Massachusetts Forward. massDOT

SOUTH COAST RAIL

Figure 2
MSRE Cross Section
Not to Scale

Prepared by: VHB



\\MABOSDATA\projects\10111.00\cad\te\planset\Stoughton\Pine Swamp Trestle\SCR PR-Rail-MSRE.dwg Printing Date: 3/9/2012 10:26 AM

0 40 80 Feet

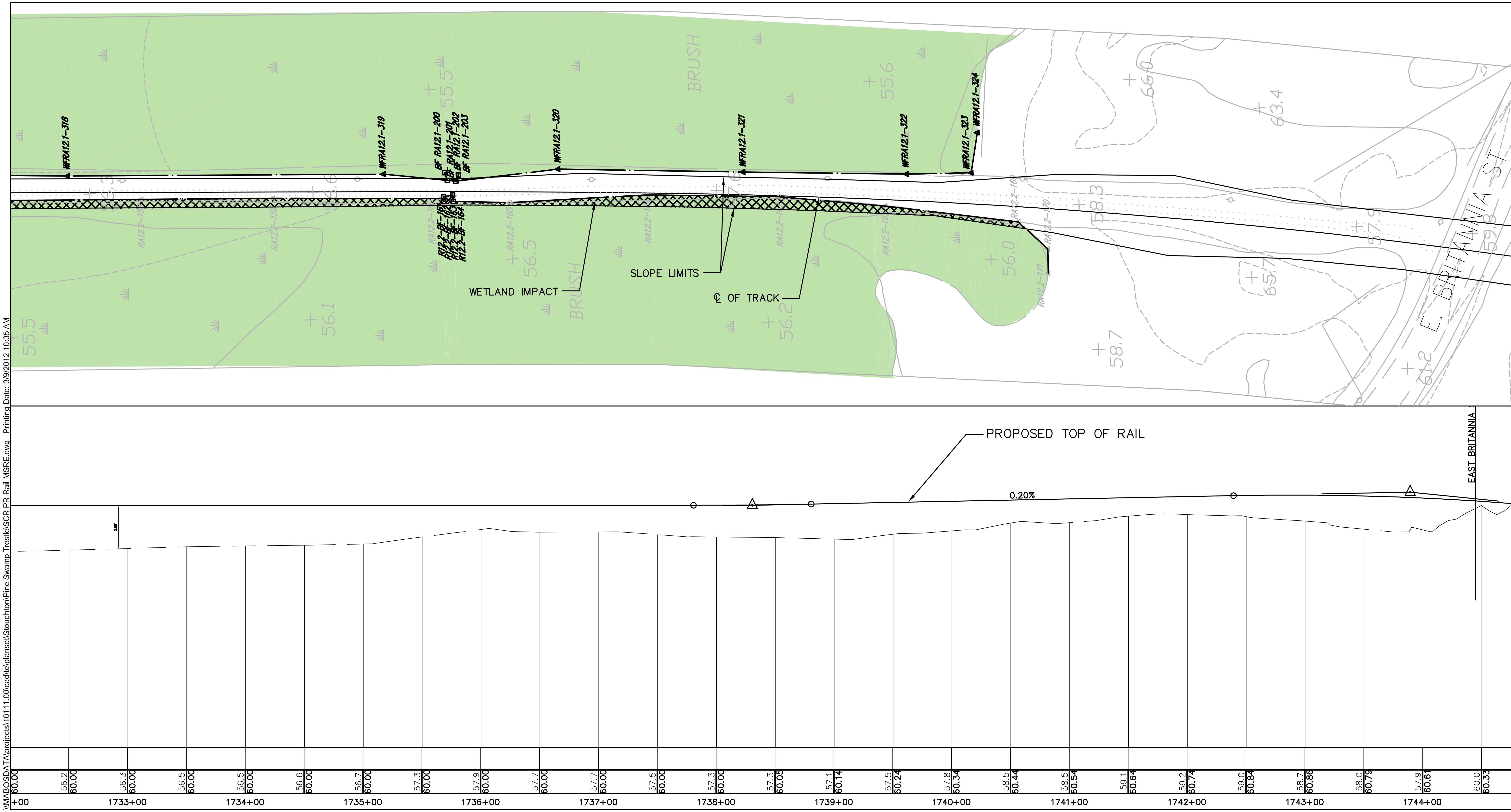
massDOT Moving Massachusetts Forward.

SOUTH COAST RAIL

Figure 3
Pine Swamp MSRE
Northern Approach

1"=80'

Prepared by: VHB



0 40 80 Feet

SOUTH COAST RAIL

Figure 4
Pine Swamp MSRE
Southern Approach

1"=80'

Prepared by: VHB

\\MABOSDATA\projects\10111.00\cad\te\planset\Stoughton\Pine Swamp Trestle\Pine Swamp Trestle Typicals.dwg Printing Date: 3/9/2012 10:56 AM

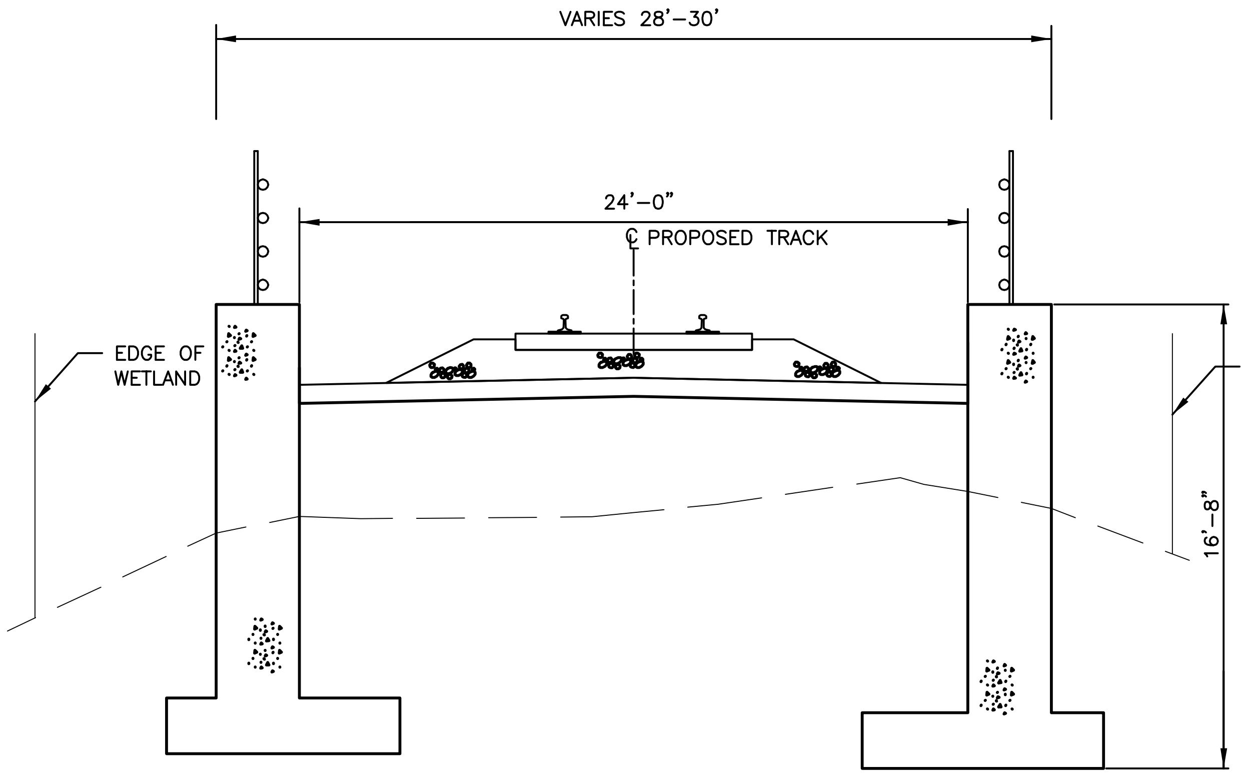


Figure 5
Transition Cross Section
Not to Scale

Prepared by: VHB

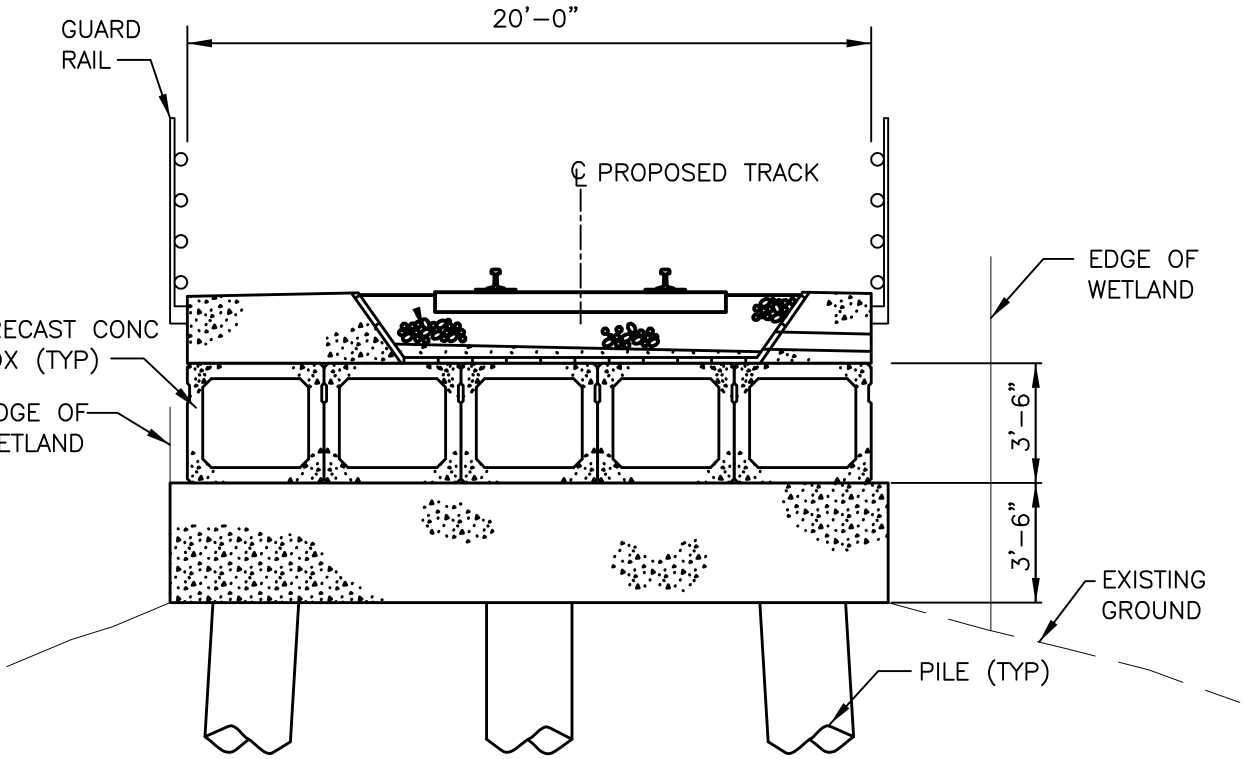
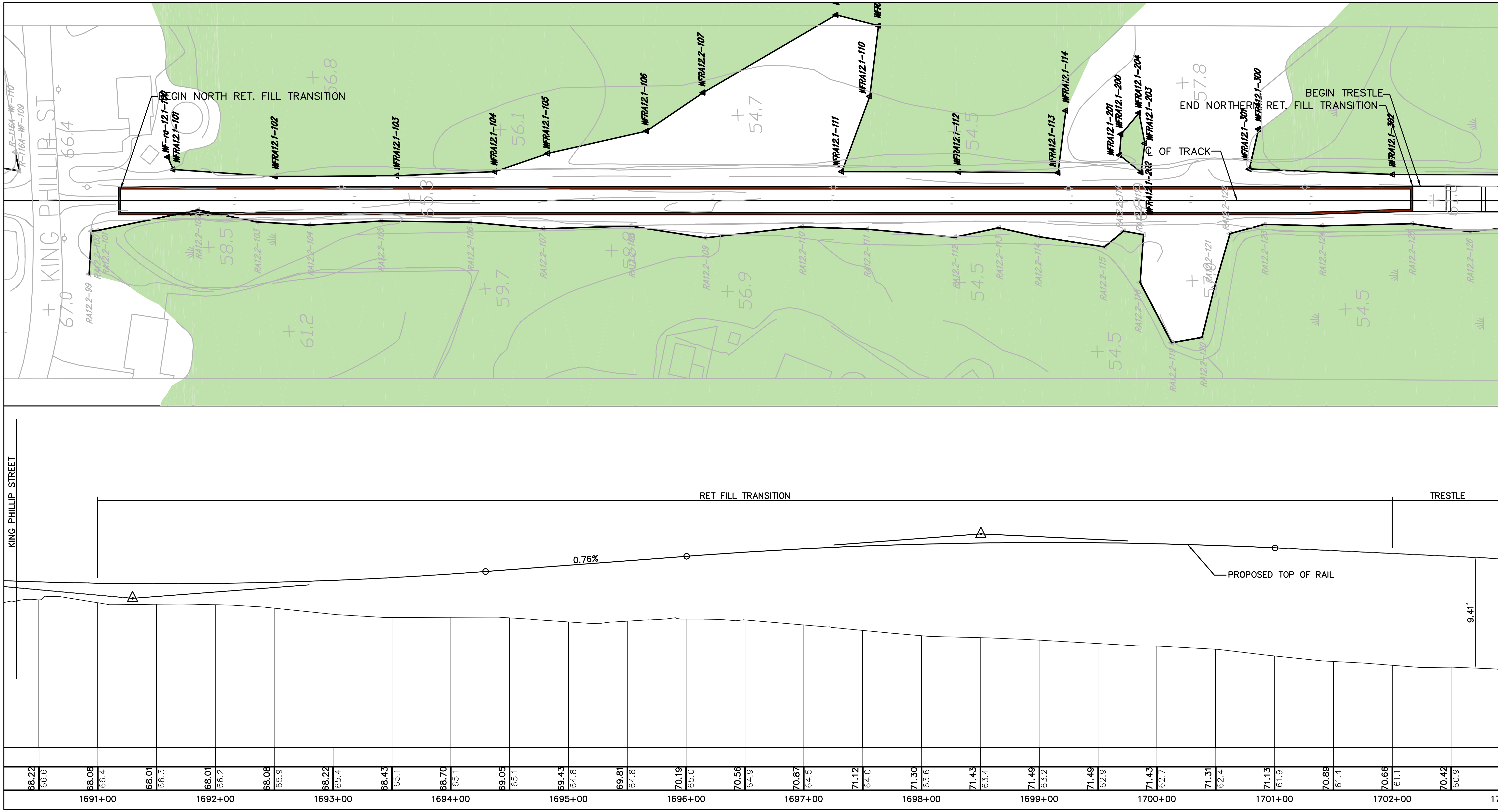


Figure 6
Trestle Cross Section
Not to Scale

Prepared by: VHB

\\MABOSDATA\projects\10111.00\cad\te\planset\Stoughton\Pine Swamp Trestle\10111XS-ST-PINESWAMPTRESTLE wall estimate rfw.dwg Printing Date: 3/9/2012 10:44 AM

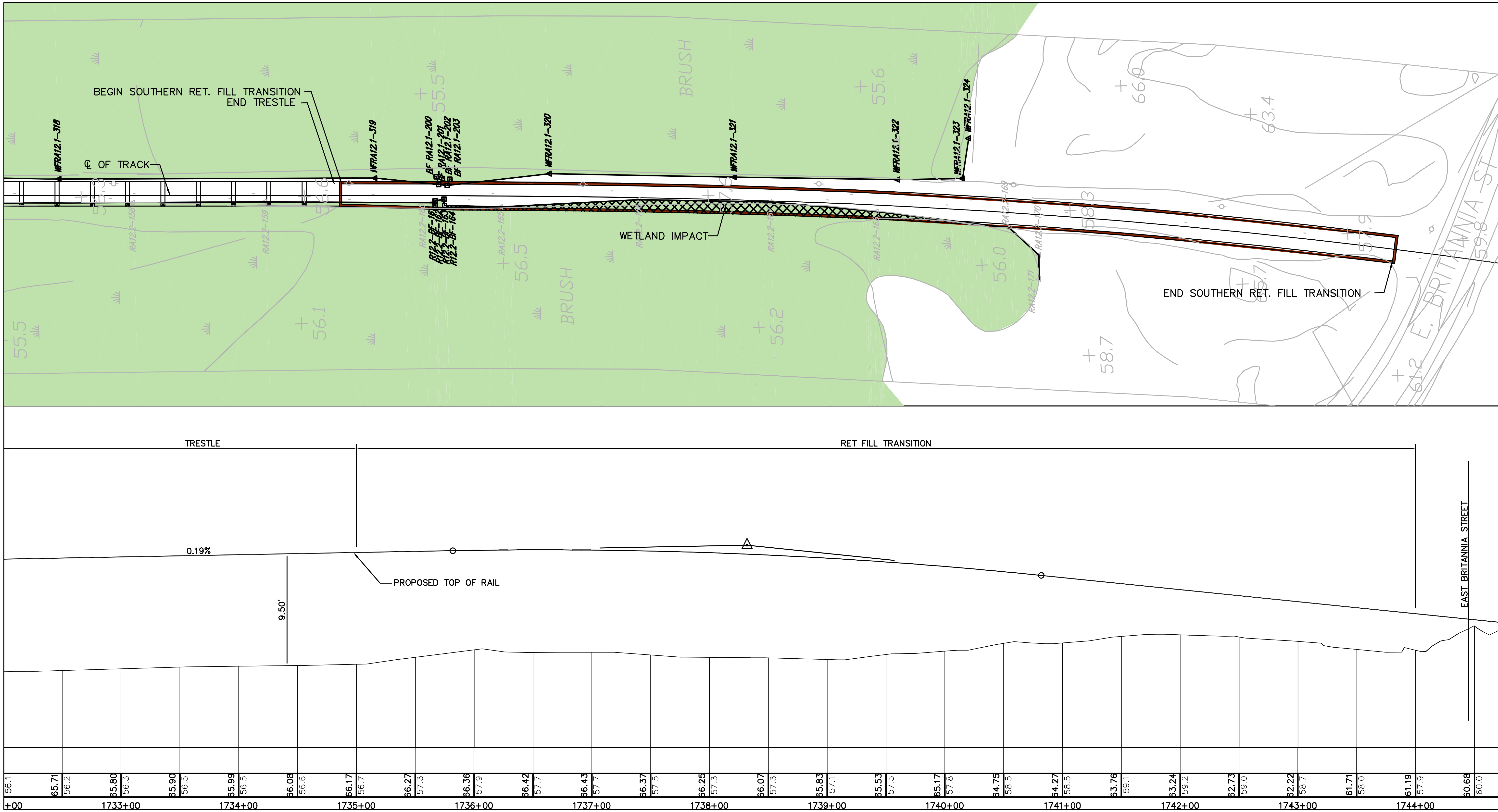


0 40 80 Feet

Figure 7
Pine Swamp Trestle
Northern Transition
1"=80'

Prepared by: VHB

\\MABOSDATA\projects\10111.00\cad\te\planset\Stoughton\Pine Swamp Trestle\10111XS-ST-PINESWAMPTRESTLE wall estimate rfw.dwg Printing Date: 3/9/2012 10:49 AM



0 40 80 Feet

Figure 8
Pine Swamp Trestle
Southern Transtion
1"=80'

Prepared by: VHB

Transportation
Land Development
Environmental
Services

Vanasse Hangen Brustlin, Inc.

99 High Street, 10th floor
Boston, Massachusetts 02111-2301
617 728-7777
FAX 617 728-7782

Meeting Notes

Attendees: Craig Foley, TMLP
Mike Horrigan, TMLP
Mark Louro, VHB

Date/Time: February 16, 2012
4:00 PM

Project No.: 10111.00

Place: TMLP
55 Weir Street
Taunton, MA

Re: South Coast Rail
TMLP coordination meeting
Pine Swamp

Notes taken by: M. Louro

The purpose of the meeting was to review the track alignment and typical section proposed through the Pine Swamp and discuss Taunton Municipal Light Plant maintenance needs. The discussion included the following.

- The track horizontal alignment will follow the existing railroad berm that runs through Pine Swamp between King Philip Street and East Britannia Street in Taunton, MA. The rail profile will be one to two feet above the existing berm profile.
- Once the track is in place TMLP will have to access their line from a high rail vehicle(s). If MBTA owns the vehicle then TMLP will have to coordinate each time access
- TMLP recently installed new poles, insulators and wire within this area so they do not expect to have to replace equipment for several years.
- TMLP inspects this line once annually.
- TMLP is concerned about not having unlimited access to this line once trains start running, especially in the event of an emergency. All inspections or work will have to be scheduled with MBTA and flaggers will be required. Much of the work that TMLP performs will be limited to off peak, night, or weekend work, which will be more costly. TMLP will be limited by the train schedule.
- A cost benefit analysis should be done to compare the cost of relocating the line to Route 138 with the cost of a high rail vehicle, flagging, training and increased labor costs to perform maintenance work at night and on weekends.
- The high rail vehicles will have to be able to auger poles, provide access to the wire and poles and haul materials.
- The existing pole line may have to be reset to provide 15 feet horizontal clearance from the proposed track and the catenary.
- The bare wire may have to be replaced by unsulated cable.
- TMLP is not sure if they have an easement agreement that defines access limitations and maintenance responsibilities related to this line.
- TMLP facilities are within the existing railroad right-of-way from Pine Swamp to the Easton Town Line/Raynham Park. The line in Raynham and Easton should be evaluated to see if relocations are warranted beyond Pine Swamp.
-

Appendix 3.2-E

Layover Facility Site Selection Report

Technical Report – DRAFT

Layover Facility Site Selection

Prepared for

Massachusetts Department of Transportation
Boston, Massachusetts

Prepared by VHB/Vanasse Hangen Brustlin, Inc.
Boston, Massachusetts

February 2012

Table of Contents

This Page Intentionally Left Blank

1

Introduction

1.1 Purpose of this Document

The Draft Environmental Impact Statement/Environmental Impact Report (DEIS/DEIR) for the South Coast Rail project, released for public review in March 2011, identified five potential sites for overnight layover facilities but did not identify a preferred site on either the Fall River or New Bedford branches. Since the release of the DEIS/DEIR, MassDOT has identified a preferred overnight layover facility location on each of the branches. The Final Environmental Impact Statement/Environmental Impact Report (FEIS/FEIR) will provide a detailed analysis of each of these two layover sites in accordance with the requirements of the Secretary of Energy and Environmental Affairs Certificate on the DEIR.

The Secretary's Certificate on the DEIR stated that:

> "The FEIR should include a rationale for selection of the preferred layover facilities and for elimination of others from further consideration. The evaluation of impacts associated with layovers should include potential conflicts and synergies with existing and future land use on and in the vicinity of the sites."

This document provides a comparison of the environmental impacts, operations, capital costs and operating costs associated with each of the five sites identified in the DEIS/DEIR (Chapter 2) and the rationale for selection of the preferred sites (Chapter 3). MassDOT is seeking public comment on the layover sites in advance of preparing the FEIR.

1.2 Purpose of the Layover Facility

The overnight layover facility is the location where trains are stored between the last trip at the end of each day and the first trip at the beginning of the next day. Efficient commuter rail operation requires that trains begin and end the day as close as possible to the outlaying terminal station. All of the MBTA's recently restored commuter rail lines, including the Greenbush, Kingston, Middleborough, and Newburyport Lines, have overnight layover facilities near the terminal station. For the South Coast Rail project, trains will start and end the day on both the Fall River and New Bedford branches; therefore, two layover facilities are needed, one on each line.

1.2.1 Location of Layover Facilities

The layover facility should be located close to the end of the line. If the layover facility is near the terminal, trains do not have to travel far to get to the start of their morning trips or from the end of their evening trips. If the layover facility is distant from the terminal, trains need to make a long distance non-revenue (deadhead) movement before they start their morning trips or after they end their evening trips.

The ideal location for an overnight layover facility is just beyond the terminal station. When trains complete a trip at the end of the day, they continue down the track into the layover facility. In the morning, they pull up from the layover facility to the first station, and then continue up the track towards Boston. There is no need for the train to reverse direction at the terminal station, and trains moving between the terminal station and the layover yard have no impact on revenue operations on the mainline track. The layover yards at Greenbush and Kingston have this type of operation.

If the area around the terminal station is constrained by urban development, environmental resources, or other limitations, it may not be possible to locate the layover facility beyond the terminal station. In this case, acceptable layover locations may be found adjacent to the mainline, as close to the terminal station as possible. The layover yards at Middleborough and Newburyport are located before the terminal station, each less than a mile.

There is no hard rule for the distance of a layover facility from the terminal, but increasing distance will result in less reliable operations and greater operating costs. The cost to the MBTA of operating a commuter rail vehicle was $11.92 per mile in 2010 based on the latest information provided by the National Transit Database.

1.2.2 Infrastructure Requirements

The area of the layover facility site must be large enough to accommodate the anticipated number of trains, service vehicles, and other support facilities. The site must be shaped appropriately to allow all tracks to be long enough to accommodate the full length of a train on each track.

Based on the operating plan that has been developed for South Coast Rail, each branch will require four trains to support the peak period service. In addition, a fifth train on each branch will be required as spare equipment, which can be used in the event of a breakdown.

The layover facility must accommodate the five trains anticipated. In addition, the facility should provide one track for future expansion of service and for maintenance equipment. Therefore, each layover site chosen for South Coast Rail must be able to accommodate six tracks.

The tracks must all be long enough to accommodate the longest train anticipated to be operated by the MBTA, which is assumed to be two locomotives and nine coaches, plus buffer space at the ends. This gives a minimum clear track length of approximately 950 feet. The tracks should be spaced with alternate 20-foot and 30-foot track centers, to allow enough space for maintenance vehicles to travel between trains. The layover facilities in Middleborough, Kingston, and Greenbush are of this style.

The site must also accommodate the yard lead track and turnouts, which means that the site must be considerably longer than 950 feet. At a minimum, the lead track must be long enough for a series of three #10 turnouts, a distance of about 400 feet. Allowing for some flexibility with track geometry, this results in the need for a site that has a rectangular shape and is approximately 1,500 feet long and 180 feet wide. The site must be able to accommodate necessary support facilities, including a storage shed, employee parking, crew facilities and storage space for maintenance equipment.

1.3 Preliminary Site Selection

The Southeast Regional Planning and Economic Development District (SRPEDD) identified 19 site alternatives for the layover facilities. Some of these sites would serve only one of the two branches, while others could serve both branches. Table 1-1 summarizes the site locations, which were described in more detail in the DEIS/DEIR Appendix 3.2-E.

Table 1-1: Potential Layover Sites Identified by SRPEDD

Site #	Site Location	Community	Terminal Distance[1]	SRPEDD Notes
Fall River Secondary				
1	Shaw Street	Fall River	-1.0[2]	Flood plain; condos, school
2	Battleship Cove (Behind Gate)	Fall River	0.0[3]	Good for only 2 tracks
3	Weaver's Cove West	Fall River	2.6	Flood plain; potential economic development conflict
3A	Weaver's Cove East	Fall River	2.6	SRPEDD note not provided for this site
4	North Fall River	Fall River	3.9	Cut section; country club, condos
5	ISP Facility	Freetown	5.3	Site size insufficient; layover footprint would need to be smaller
6	Saw Mill	Freetown	6.4	Sharp curve onto site
7	Copicut Road (North)	Freetown	6.9	Poor road access; poor lot shape
8	Copicut Road (South)	Freetown	6.9	Length and width may be problem
9	Boston Beer Site	Freetown	7.9	Town wants site for economic development
New Bedford Main Line				
10	Wamsutta Street	New Bedford	0.3	Poor ped link to downtown; no mixed use; SRTA bus
11	Wye (South of Nash Road)	New Bedford	1.3	Large wetlands; sharp curve, steep grade
12	Shawmut Avenue	New Bedford	1.3	Wetlands, streams; inadequate width
13	Church Street (East)	New Bedford	3.1	Good
14	Church Street (West)	New Bedford	3.1	Takings; wetlands issues
15	Off Braley Road	Freetown	7.4	Takings
16	South of Chace Road	Freetown	8.3	Cranberry bog; takings
Myricks Junction				
17	Myricks (Southeast)	Berkley	13.6	Inadequate width
18	Myricks (Northwest)	Berkley	14.3	Inadequate width
19	Myricks (SE Jct)	Berkley	13.6	Inadequate width; environmental concerns

1. Terminal distance is measured in miles from Battleship Cove Station on the Fall River Secondary and from Whale's Tooth Station on the New Bedford Main Line. Terminal distances for the sites near Myricks Junction are measured using the longest distance from the two terminal stations.
2. Negative distance indicates site is beyond the terminal station.
3. The configuration of the Battleship Cove site would require trains to cover approximately 1 mile, including reversing direction to access Battleship Cove Station. Accessing Fall River Depot would not require reversing direction.

Alternative sites were evaluated based on civil design, operations impact, anticipated environmental impact, and socioeconomic impact criteria. For the preliminary assessment, detailed design for each site was not feasible. Alternatives were evaluated based on general knowledge of the site layout, general operations knowledge, existing available macro-scale environmental information, and general knowledge of development in the surrounding area.

Civil design was assessed by examining several issues:

- Ability of the site to accommodate the layover facility
- Shape, layout, and grading of the site

- Complicated construction items, such as rebuilding bridges or large retaining walls

Operations impact was assessed by considering the distance of the site from the terminal station. The further a site is from the terminal, the more difficult operations become, because trains traveling to and from the layover facility will interfere with the mainline for a longer period of time, and therefore further restrict the time available for revenue train movements.

Anticipated Environmental impact was assessed by examining several issues:

- Need to fill in rivers, ponds, or other water bodies
- Need to fill in wetlands
- Need to acquire public open space

Socioeconomic impact was assessed by examining several issues:

- Property impacts, especially to developed land
- Proximity to residential development

As described in detail in the DEIS/DEIR Appendix 3.2-E, the assessment of the 19 preliminary sites concluded with the recommendation that five sites be advanced for further analysis:

- Site #3: Weaver's Cove West
- Site #3A: Weaver's Cove East
- Site #5: ISP Facility
- Site #10: Wamsutta Street
- Site #14: Church Street West

1.4 Public Involvement

The layover facilities have been the subject of continued public involvement since early in project development. This section describes the specific civic engagement activities associated with each site. While the proposed facilities were discussed in general project meetings, this section outlines the specific site consultation.

1.4.1 Public Meetings

MassDOT conducted Public Meetings in Fall River and New Bedford as part of the alternatives analysis and station siting. The following activities were conducted related to the stations and layover facilities:

- Two Station Workshops were held in New Bedford on November 13 and November 19, 2008. The subjects of the meetings were about uses of the potential station sites and included information about land uses near the potential Whale's Tooth site, which may include a layover facility. Meeting notices were translated into Spanish and Portuguese. Key concerns included the need to support economic development in the City of New Bedford and noise and safety issues around the station. Participants noted the need to support the activities of the Port.
- An Open House and Public Meeting were held in Fall River on September 17, 2009. The meeting was advertised in the Fall River Herald, direct abutters to the Fall River proposed sites were notified by mail and follow-up phone call, where possible, and the regional planning agency distributed flyers in the area near the potential sites. During the Open House, maps and photos of the potential sites were available, along with staff members who outlined the potential locations, size and operations to interested participants. Most of the questions raised during the Open House related to operation of the facility, when trains would start out of the site, when they would return; if there would be air quality impacts; how the MBTA acquires property; how the meeting was noticed. During the Public Meeting, the Project Manager outlined the potential rail layover facilities and responded to questions. No major questions were raised about the layover site during the meeting.

1.4.2 City of New Bedford

MassDOT met with the City of New Bedford on February 2, 2009. The need for and characteristics of layover facilities were described, using an aerial photograph of the Kingston layover facility for reference. The following comments were provided concerning Site #10, Wamsutta Street:

- It was noted that this is the same site as proposed in the 2002 FEIR, and that the CSX freight tracks for the harbor dredging project had been constructed to accommodate that concept.
- It was noted that the Wamsutta Mill complex on the opposite side of Wamsutta Street had been converted into a residential development.
- It was suggested that there is a need for coordination of projects in the area, including the layover facility, station, and potential for properties between the ROW and Route 18.
- It was suggested that structured parking could be a buffer between neighborhoods and the layover site.

- It was suggested that access over Route 18 between the station on the east and the neighborhoods on the west was very desirable.
- It was suggested that the industrial area to the east would not be impacted by the layover facility.
- Overall, the city would support the site, especially if the area had a comprehensive plan to help connect the station to neighborhoods.

The following comments were provided concerning Site #14, Church Street West:

- It was suggested that access to the parcel could be difficult.
- It was suggested that this was the best parcel from an economic development perspective.

MassDOT met with City officials again on July 26, 2010, to review the City's plans for the potential layover site, among other issues.

The port authority shared a study with MassDOT suggesting that the port would need significantly more space on the site for storage of rail cars.

There was a discussion about the potential to fit both needs, storage and layover, on the location, especially if there is no further development at Hicks Logan. Mayor Lang said he would defer to passenger rail over freight.

The City reminded MassDOT that space needs to be preserved on the site for ferry parking.

1.4.3 Town of Freetown

MassDOT met with the Town of Freetown on February 2, 2009. The need for and characteristics of layover facilities were described, using an aerial photograph of the Kingston layover facility for reference. The following comments were provided concerning Site #5, ISP Facility:

- It was noted that Exit 8½ is just to the north, and archeological resources were encountered on that project.
- It was noted that the ISP Facility is subject to significant homeland security restrictions.
- It was noted that this is the same site as proposed in the 2002 FEIR.

The following comments were provided concerning Site #6, Sawmill:

- It was suggested that a layover facility was not consistent with the potential TOD, the character of the town, or the goals for the area.

- It was questioned how potential residents and business at a future TOD would view the layover facility.

1.4.4 City of Fall River

MassDOT met with the City of Fall River on February 2, 2009. The need for and characteristics of layover facilities were described, using an aerial photograph of the Kingston layover facility for reference. The following comments were provided concerning Site #3, Weaver's Cove West:

- It was noted that the site is a brownfield and that there are few residences nearby.
- It was questioned whether the rest of the site would be developable if a portion was used for a layover.
- It was noted that the site would face challenges with the proposed LNG development.
- Overall, the city thought the site had good potential.

2

Sites Evaluated in the DEIS/DEIR

2.1 Introduction

As described in the DEIS/DEIR Chapter 3 (page 3-62 to 3-63), two alternative sites were identified on the New Bedford Main Line and three on the Fall River Secondary. This chapter provides a description of each site, and a comparison of the sites based on environmental impacts, operational considerations, conceptual acquisition cost estimate and the operating and maintenance costs for each site, based on information presented in the DEIS/DEIR.

2.2 New Bedford Line

Two overnight layover sites were evaluated in the DEIS/DEIR: Church Street and Wamsutta.

2.2.1 Church Street Site

The proposed Church Street site layover facility (Figure 2-1) would be constructed along the New Bedford Main Line and would serve all rail alternatives. It would be located in New Bedford between Church Street and Route 140, near where Route 140 crosses the New Bedford Main Line, approximately 3.1 miles from the southern terminus of the New Bedford Main Line. This site is located on the west side of the right-of-way, on the site of an existing waste disposal industry, near milepost 51.5.

- Distance from Terminal – 3.1 miles north of Whale's Tooth Station
- Lead Track – double lead track
- Length of yard – 1,500 feet

- Width of yard – 200 feet
- Number of storage tracks – six tracks (typical); five tracks for anticipated trains with a spare plus one for future expansion and maintenance equipment
- Highway Access – directly off existing private Pig Farm Road, connecting to Church Street

2.2.1.1 Land Use and Acquisitions

The Church Street site consists of two parcels of previously developed land within an industrial area. It is currently a junk yard (Frade's Disposal Company), with several buildings and stockpiles of materials distributed across the cleared area. Adjoining properties include transportation corridors, industrial land use, undeveloped land, and open space. Nearby properties include residential development to the east and Acushnet Cedar Swamp State Reservation to the west, across Route 140. Land uses and public or private ownership of the parcels that would be acquired to construct a layover facility at the Church Street site are listed in Table 2-1.

Table 2-1 Layover Facility at the Church Street Site: Acquisition Parcel Land Uses

City/Town	Public Ownership		Private Ownership					
				Land Use Area (acres)				
	Number of Parcels	Area (acres)	Number of Parcels	Residential	Commercial	Industrial	Undeveloped	TOTAL
New Bedford	0	0	2	0	0	9.18	29.63	38.81

Sources: MassGIS 2002, 2005; municipal data 2009, aerial mapping, and online research (various).

The parcels that would be acquired to construct a layover facility at the Church Street site, and the approximate tax revenue and job losses, are listed in Table 2-2.

Table 2-2 Layover Facility at the Church Street Site: Land Acquisition

Parcel Number	Ownership	Generalized Zoning	General Land Use	Property Tax Revenue Loss	Job Loss	Area (acres)	Percent Acquisition
125-10	Private	Industrial	Undeveloped	$1,234.54	TBD	9.18	100.0
129-41	Private	Industrial	Industrial	$20,143.80	TBD	29.63	100.0
TOTAL				$21,378.34		38.81	

Sources: MassGIS 2002, 2005; municipal data 2009, aerial mapping, and online research (various).

The layover facility at the Church Street site would require 38.81 acres (two parcels) of privately owned land. Business displacement would result from these acquisitions. Industrial buildings on parcel number 129-41 would be acquired to construct the layover facility. Job losses from the disposal and recycling business would be expected but have not been quantified. No residential or community facility displacements would result from these acquisitions for the Church Street site. The layover facility would make the portions not used for a layover inaccessible for future development. Complete acquisitions would be required as a result.

The two parcels would be wholly acquired; property tax revenue losses for the City of New Bedford are estimated at $21,378.34 per year, in 2009 dollars.

The Church Street site is not within or adjacent to any incompatible land use. The site and adjacent lands between Church Street and Route 140 are in industrial use. There are no plans to change land uses or zoning in this area.

2.2.1.2 Environmental Justice

Although there are no environmental justice communities within the layover site, an environmental justice neighborhood is located less than 0.5 mile northeast of the proposed layover facility, to the east of the New Bedford Main Line. Residents living within this neighborhood meet low income and minority criteria for designation. However, no parcels within an environmental justice neighborhood would be acquired for the Church Street site layover facility. There would be no land acquisition impacts to environmental justice populations.

2.2.1.3 Noise Impacts

Noise at all of the proposed South Coast Rail layover facilities would be dominated by train's idling locomotives. As per MBTA policy, trains that will remain at the layover facilities for one hour or longer will be shut down and attached to electrical power, as needed. Other minor noise sources on the site are not expected to contribute to the overall sound levels and impacts. Distances to moderate and severe noise impacts at the layover facilities were calculated based on the Source Reference Level of 109 dBA at 50 feet as cited in the FTA Guidelines[1]. The layover facility sound level was projected to the receptor locations based on propagation of noise over distance. The existing sound levels, the project sound levels, and the number of impacts are shown in Table 2-3. There would be no noise impacts associated with this location.

[1] Transit Noise and Vibration Impact Assessment, Federal Transit Administration, May 2006

Table 2-3 Church Street Layover Facility Sound Levels and Impacts

Location	Noise Exposure at 50' (Ldn)	Existing Noise Exposure (Ldn)	Moderate Impact Ldn	Moderate Impact Number of Impacts	Severe Impact Ldn	Severe Impact Number of Impacts
Church Street	79.8	55	55.3	0	61.2	0

Assumptions:

- A Source Reference Level of 109 dBA at 50 from the center of the site for layover tracks was used (FTA Guidelines, Environmental Consequences Technical Report - Noise).
- All facilities are assumed to have one train idling per hour (day and night).

2.2.1.4 Wetlands and Waterways

The site is largely comprised of the junk yard facility, with the remainder of the site characterized as forested areas. There are three wetland resources on the site located on the northeast, northwest and southern portions of the site. These resources are best characterized as forested wetlands. The wetland resources on site are regulated as Bordering Vegetated Wetlands (BVW) under the WPA and under federal jurisdiction. The site is not within any drinking water protection areas or adjacent to any waterbodies.

The proposed layover site would permanently impact approximately 0.07 acres of BVW classified as wooded swamp deciduous (PFO) wetlands and temporarily impact approximately 0.06 acres. These wetland impacts are associated with the wetland system along the eastern and southern sides of the site. Wetlands were avoided to the extent practicable during the conceptual design process to minimize impacts. No impacts to Bank, Riverfront Area, or BLSF are anticipated at this site. The wetland delineations created using the GIS model are expected to overestimate the size of the wetland and therefore the impacts. Wetland impacts would be re-evaluated once the preferred alternative is selected and wetland boundaries have been delineated in the field. Based on preliminary data, approximately 0.25 acres of wetland mitigation would be required.

2.2.1.5 Wild and Scenic Rivers

The Church Street site is not adjacent to any Wild and Scenic River.

2.2.1.6 Threatened and Endangered Species

According to the 2008 edition of the Natural Heritage Atlas and information from NHESP, there are no certified or potential vernal pools located on the property, nor is the property within Estimated or Priority Habitat of Rare Wildlife.

2.2.1.7 Chapter 91 and Coastal Zone

The Church Street layover site is outside of the Coastal Zone and does not require work within filled tidelands.

2.2.1.8 Hazardous Materials

The Church Street site consists of two previously developed parcels within an industrial area, currently occupied by a disposal and recycling operation. The northern portion of the Site is wooded and undeveloped. The remaining portion of the Site is used by the Frade's Disposal Company which operates the solid waste recycling, scrap metal recycling, and trash pick-up and disposal company. Based upon the Phase 1 Environmental Site Assessment conducted for the Church Street layover site, four recognized environmental concerns (RECs) and three potential environmental concerns were identified and are described below[2].

The four RECs described in Table 2-4 may have resulted in the release of oil or hazardous materials to soils or groundwater at the site. During the site reconnaissance of April 30, 2009, an area of pooled oil as well as a larger area of stained soil was observed on the ground surface in an unpaved area located in the western portion of the Frade's facility which is approximately 300 feet to the west of the proposed Site boundaries. The pooled oil was located in an area staging large trucks and other heavy equipment which utilize oil or hazardous materials (OHM). The presence of pooled oil and stained soil could represent a release that would require notification to the DEP. In addition, this condition may have impacted subsurface soil and ground water at the Site and therefore is considered a REC with a medium potential impact[3].

[2] Recognized Environmental Conditions (RECs), as defined by the ASTM E1527-05 standards, "means the presence or likely presence of any hazardous substance or petroleum products on a property under conditions that indicate an existing release, a past release, or a material threat of a release of any hazardous substances or petroleum products into structures on the property or into the ground, ground water, or surface water of the property. The term includes hazardous substances or petroleum products even under conditions in compliance with laws."

[3] The ASTM Standard requires an opinion regarding the potential for each REC to affect the site. The potential impact for each REC identified, based on available information, is classified as either high, medium, or low. Criteria used to determine the potential impact are discussed below:

A 3,000 gallon diesel above-ground storage tank (AST) with a fuel dispenser pump was observed outside in the center of the Frade's facility. Even though a concrete pad was located under the AST, a large area of stained soil was observed around the dispenser pump and had migrated off the concrete pad onto the ground surface. The exterior of the AST was also rusted. The potential release of oil which may have occurred in this area over time could have impacted subsurface soil and ground water at the Site and therefore is considered a REC with a medium potential impact.

Table 2-4 Summary of RECs at the Proposed Church Street Layover Site

REC Description	Release Tracking Number (RTN)	Relative Impact
Current Existence of 3,000 Gallon Diesel Aboveground Storage tank with Stained Soil on Site	Not applicable	High
Presence of Pooled Oil and Stained Soil in Unpaved Area Near Site	Not applicable	Medium
Historic and Current Use of Area Near Site for Vehicle Repair and Maintenance	Not applicable	Medium
Existence of Underground Storage Tanks Near Site	Not applicable	Low

- RECs that are deemed to have a high potential impact consist of sites such as those with confirmed soil, ground water, and/or indoor air impacts that either were not reported to DEP or were reported to the DEP and have undergone some type of cleanup or remain an active case. Those properties that have undergone a cleanup and have achieved a Permanent Solution, such as an Response Action Outcome (RAO), are still considered high potential impact due to the fact that changing site use or regulations, construction activities, a DEP audit of the RAO, or identification of new environmental conditions (such as indoor air impacts in nearby structures) could trigger the need to conduct additional assessment and/or remediation activities. Other RECs with high potential impacts are those in which UST installation records exist but for which removal documentation is absent, indicating a likelihood that USTs may be present and those where the historic use of the property indicate that significant quantities of OHM were used and could constitute the a release of OHM.
- Properties with RECs that are deemed to have a medium potential impact consist of properties such as those with potential sources of OHM with limited or inconclusive information. For instance, a single-walled steel UST which has been removed, but limited or no documentation was available to show that proper sampling was conducted at the time of the UST removal to confirm that the UST did not leak, may be deemed a REC of medium potential impact.
- RECs that have low potential to impact a site include off-site properties where releases have occurred but have been mitigated or USTs where proper documentation is available indicating a release has not occurred, as well as for properties that have more recently installed USTs equipped with leak detection, are double walled, and/or contain overfill protection and spill containment.
- The findings also include a section for potential environmental concerns which are also known as de minimis conditions. These potential environmental concerns typically have less of a potential to impact a property than RECs, as they generally do not present a threat to human health or the environment and would not be the subject of an enforcement action if brought to the attention of appropriate governmental agencies. An example of a potential environmental concern or de minimis condition would be the potential presence of asbestos containing materials and lead based paint based on the age of the building, which would have to be properly managed during building demolition

Mr. Frade stated that approximately 25 vehicles, including garbage and recycling trucks, are repaired and maintained at the Frade's Disposal repair garage which is located approximately 200 feet west of the proposed Site boundaries. An inspection of the repair garage by the DEP in 1998 indicated that the waste oil collection area was not being properly managed and displayed evidence of excessive spillage. The improper management, storage, use, and/or generation of these products may have or could result in a release of OHM which constitutes a REC with a medium potential impact.

It is possible that one or both of the underground storage tanks recorded on the site may still be present and OHM associated with the USTs on this property may also be present which would constitute a REC with a medium potential impact.

The Church Street layover site has three potential environmental concerns including:

- The property was historically used for the growing of crops. Therefore, pesticides, herbicides, and fertilizers may have been used and because of their persistence, may still be present in Site soils.
- A pad mounted electrical transformer is located in a shed in the western portion of the Frade's Disposal facility. Mr. Frade stated that the transformer is owned by NSTAR. It is not known if this transformer contains PCB transformer oil. The transformer has the potential to leak transformer oil directly onto the ground surface.
- During the site reconnaissance, the Frade's Disposal facility was being used for the storage of drums, tires, trucks, scrap metal, machinery, plastic, metal, and other recyclable materials, including bins of computer monitors and other miscellaneous debris and trash. The general storage of materials in this manner indicates historically poor housekeeping practices and a potential for impacts to soil or groundwater.

The presence of these RECs and potential concerns will require additional Phase II site investigations to characterize soil and groundwater contamination, determine the extent of contamination, and evaluate the cost of remediation. Based on the Phase I investigation, the overall impacts of to site construction costs are ranked as "medium".

2.2.1.9 Cultural Resources

The Church Street Layover Facility is located on the west side of the New Bedford Main Line rail ROW near Church Street. No National Register listed, determined eligible, or recommended eligible historic properties have been identified in the Area of Potential Effect (APE).

Historic Resources

No historic properties have been identified within the site or in the APE for the Church Street site layover facility. Therefore, there will be no impacts to historic resources.

Archaeological Resources

The entire project parcel is assessed as having moderate archaeological sensitivity for pre-contact/contact Native American habitation and resource procurement/processing sites and under-documented post-contact Euro-American agricultural-related cultural deposits. The current conceptual plan depicts construction activities within the sensitive areas. An intensive (locational) archaeological survey with subsurface testing is needed to identify any archaeological sites in the sensitive areas where project construction impacts may occur.

2.2.1.10 Operational Constraints

The New Bedford Main Line through this section of the corridor is single track until the bridge crossing at Tarkiln Hill Road where it becomes double track. Trains exiting the Church Street layover facility would enter the New Bedford Main Line on a single track and would travel approximately 1 mile southbound before entering the double track section. Under normal operating conditions, there is minimal chance of conflict through this area given the headways of 40 minutes, considerably longer than the time required for a train to travel from the layover facility to the station and back. If trains throughout the rest of the rail system are delayed that could cause delays on the New Bedford Main Line. When this occurs there is potential for conflict between passenger trains making their final trip to the Whale's Tooth Station and trains heading north towards the Church Street Site. The trains heading towards the layover facility could wait on the double track section for the southbound train to pass which would only cause minor delays to the trains heading for the layover facility.

2.2.1.11 Operations and Maintenance Costs

Since the Church Street Site is approximately 3.1 miles from the terminal station on the New Bedford Main Line, that would create 3.1 miles of non-revenue service each train would need to run twice a day, once in the morning and once in the evening. The cost to the MBTA of operating a commuter rail vehicle was $11.92 per mile in 2010 based on the latest information provided by the National Transit Database. For the 6.2 miles of non-revenue service for each of the four eight-car trains, the yearly operating cost for trains operating from this layover facility alternative would be approximately $567,600.

Additional costs that would be incurred are related to the degradation of the equipment. By adding an additional 6.2 miles of travel for the trains each day, that will quickly decrease the value of the equipment compared to having a layover facility in close proximity to the terminal station.

2.2.2 Wamsutta Site

The proposed Wamsutta site layover facility (Figure 2-2) would be constructed along the New Bedford Main Line and would serve all rail alternatives. It would be located in New Bedford near the intersection of Wamsutta Street and Herman Melville Boulevard, near the southern terminus of the New Bedford Main Line, immediately north of the Whale's Tooth Station. This site is located on the east side of the right-of-way, opposite the proposed Whale's Tooth Station and adjacent to an existing freight rail yard, near milepost 54.7.

- Distance from Terminal – 0.3 miles north of Whale's Tooth Station
- Lead Track – single lead track
- Length of yard – 1,200 feet
- Width of yard – 200 feet
- Number of storage tracks – six tracks (typical); five tracks for anticipated trains with a spare plus one for future expansion and maintenance equipment
- Highway Access – 400-foot driveway to Wamsutta Street

2.2.2.1 Land Use and Acquisitions

The Wamsutta site is a previously developed site, currently used as a rail yard by MassCoastal Rail, within an industrial area. The site is visible from adjacent roads and buildings. Adjoining properties are transportation corridors and industrial land uses. Industrial sites are located north, east, and south of this location, and Route 18 to the west. No commercial or residential properties, or open spaces, are located in close proximity to this site. The land use and ownership of the parcel that would be acquired to construct a layover facility at the Wamsutta site are listed in Table 2-5.

Table 2-5 Layover Facility at the Wamsutta Site: Acquisition Parcel Land Uses

City/Town	Public Ownership		Private Ownership					
				Land Use Area (acres)				
	Number of Parcels	Area (acres)	Number of Parcels	Residential	Commercial	Industrial	Undeveloped	TOTAL
New Bedford	1	11.02	0	0	0	0	0	0

Sources: MassGIS 2002, 2005; municipal data 2009, aerial mapping, and online research (various).

The layover facility at the Wamsutta site would require 11.02 acres (one parcel) of publicly owned land. No residential, business, or community facility displacements would result from this acquisition for the Wamsutta site. Parcel number 72-275 is owned by Housing 70 Corporation (the City of New Bedford); no property tax revenue loss would result from acquiring this parcel.

The Wamsutta site is not within or adjacent to any incompatible land use. The site and adjacent lands between Route 18, Wamsutta Street and Herman Melville Boulevard are in industrial or transportation use. There are no plans to change land uses or zoning in this area. Use of this site as a layover facility was incorporated into the Transit-Oriented Development concept for the Whale's Tooth Station area.

Table 2-6 Layover Facility at the Wamsutta Site: Land Acquisition

Parcel Number	Ownership	Generalized Zoning	General Land Use	Property Tax Revenue Loss	Job Loss	Area (acres)	Percent Acquisition
72-275	Public	Industrial	Undeveloped	0	No	11.02	100.0

Sources: MassGIS 2002, 2005; municipal data 2009, aerial mapping, and online research (various).

The layover facility would make the portions not used for a layover undevelopable, requiring complete acquisition of the property.

2.2.2.2 Environmental Justice

The Wamsutta site layover facility is located within an environmental justice census block that meets low income and minority criteria for designation. Adjacent to and north of the north of the proposed layover facility is an environmental justice census block that also meets foreign-born criteria for designation.

The Wamsutta site is within and near environmental justice census blocks in New Bedford. The site is within a census block meeting environmental justice low income and minority criteria, and is close to (within 0.5 mile of) other areas meeting foreign-born, minority, and/or income criteria. The direct land acquisition impacts to environmental justice populations that would potentially result from constructing and using a layover facility at the Wamsutta site are described below. One publicly owned parcel would be acquired for the Wamsutta site layover facility, as listed in Table 2-7.

Table 2-7 Wamsutta Site: Environmental Justice Land Acquisition

Municipality	Parcel Number	Ownership	Generalized Zoning	General Land Use	Environmental Justice Categories	Area (acres)
New Bedford	72-275	Public	Industrial	Transportation (Rail)	Income, Minority	11.02

Sources: MassGIS 2002, 2005; municipal data 2009, aerial mapping, and online research (various).

Although the Wamsutta site is located within an environmental justice census block, the site is owned by the City of New Bedford. No privately owned environmental justice neighborhood land would be acquired for constructing a layover facility at the Wamsutta site. There would be no impacts to environmental justice populations because no residences or jobs would be lost.

2.2.2.3 Noise Impacts

Noise at all of the proposed South Coast Rail layover facilities would be dominated by train's idling locomotives. Trains that will remain at the layover facilities for one hour or longer will be shut down and attached to electrical power, as needed. The other minor noise sources on site are not expected to contribute to the overall sound levels and impacts. Distances to moderate and severe noise impacts at the layover facilities were calculated based on the Source Reference Level of 109 dBA at 50 feet based on FTA Guidelines. The layover facility sound level was projected to the receptor locations based on propagation of noise over distance. The existing sound levels, the project sound levels, and the number of impacts are shown in Table 2-8. There would be no noise impacts associated with this location.

Table 2-8 Wamsutta Layover Facility Sound Levels and Impacts

Location	Noise Exposure at 50' (Ldn)	Existing Noise Exposure (Ldn)	Moderate Impact		Severe Impact	
			Ldn	Number of Impacts	Ldn	Number of Impacts
Wamsutta	79.8	60	57.8	0	63.4	0

Assumptions:

- A Source Reference Level of 109 dBA at 50 from the center of the site for layover tracks was used (FTA Guidelines, Environmental Consequences Technical Report - Noise).
- All facilities are assumed to have one train idling per hour (day and night).

2.2.2.4 Wetlands and Waterways

Although the Wamsutta site is within 100 feet of a jurisdictional wetland, it would not impact this wetland.

2.2.2.5 Wild and Scenic Rivers

The Wamsutta site is not adjacent to any Wild and Scenic River.

2.2.2.6 Threatened and Endangered Species

According to the 2008 edition of the Natural Heritage Atlas and information from NHESP, there are no certified or potential vernal pools located on the property, nor is the property within Estimated or Priority Habitat of Rare Wildlife.

2.2.2.7 Chapter 91 and Coastal Zone

The proposed construction of the Wamsutta layover facility would be located in landlocked tidelands and would be exempt from licensing under 310 CMR 9.04(2). The construction of the Wamsutta layover facility would require a Public Benefit Determination under 301 CMR 13.00.

The layover facility would be located entirely within the coastal zone associated with New Bedford Inner Harbor but is not within the New Bedford/Fairhaven Designated Port Area (DPA). The construction would require a Federal Consistency Certification under the Massachusetts Coastal Zone Management Program (MCZMP). Preliminary consultation with representatives of the MCZMP indicates that the proposed facility would likely be determined to be consistent with the regulatory policies of the MCZMP.

2.2.2.8 Hazardous Materials

The Wamsutta layover site is located on a triangular shaped property in a commercial and light industrial area of New Bedford (Figure 2-2). The Site is located south of Wamsutta Street, east of the railroad tracks, and west of Herman Melville Boulevard and is approximately 12 acres in size. Due to immobile soil contamination, the Site was capped with a geotextile membrane in approximately 2004. Railroad tracks abut the Site to the west and travel off site to the north. Railroad tracks also travel from the northeastern Site boundaries to the harbor which is located approximately 100 feet to the east. The trains haul dredged sludge from the harbor to the east and travel to the Site for off-site disposal.

Based upon the tasks conducted for this Phase I ESA, five RECs and three potential environmental concerns associated with the Site were identified and are described below and in Table 2-9.

Table 2-9 Summary of RECs at the Proposed Wamsutta Layover Site

REC Description	Release Tracking Number (RTN)	Relative Impact
Historic Use of Site as Freight Yard and Placement of Permanent Engineered Barrier Above Impacted Soil at Site	4-118	Medium
Documented Release at Acushnet Estuary (New Bedford Superfund Site)	4-122	Medium
Documented Release at Adjoining Property (618 Acushnet Avenue)	4-14791	Low
Documented Release and Implementation of Activity and Use Limitation at Nearby Property (1 Wamsutta Street)	4-11715	Low
Documented Release at Nearby Property (New Bedford Main Interceptor)	4-127	Low

The former Conrail Yard comprising the Site was managed as a voluntary Brownfield site. The center of the Site contained elevated concentrations of PCBs, arsenic, lead, and polycyclic aromatic hydrocarbons (PAHs) with the perimeter having lower concentrations of these contaminants in soil. An agreement was reached with the DEP and EPA based on the financial infeasibility of remediation at the Site. The contamination was proposed to be left in place with proper engineering controls, such as a soil geotextile composition cap and land use restrictions consisting of an Activity and Use Limitation (AUL) in the areas exhibiting the highest concentrations of contamination above the Upper Concentration Limits. Since contaminated soil was left in place, there are potential impacts related to exposure during future soil disturbance at the Site during construction related to the South Coast Rail Project. The potential impact of this REC is considered medium because exposure is limited due to the engineered barrier and the existence of an AUL.

The Acushnet Estuary, a water body located to the east of the Site, was placed on the National Priorities List and became a Superfund site in 1983. This site contains PCB contamination that affects ambient air, surface water, ground water, soils, sediment, and the food chain. Although adequately regulated under State and Federal regulations, the PCB contamination associated with this site is widespread and has the potential to have impacted the subject Site historically or potentially impact it in the future through continued contaminant migration and is considered a REC with a medium potential impact.

A No. 2 fuel oil UST release from a western adjoining property, the Department of Employment and Training, located at 618 Acushnet Avenue, was identified in June 1999. A total of 20 tons of petroleum contaminated soil was removed from the property. A Class A-2 Release Action Outcome (RAO), indicating that a Permanent

Solution was achieved but that contamination was not reduced to background, was submitted to the DEP. The anticipated direction of ground water flow is to the east toward the property comprising the Site. However, given the quantity and regulatory status, this REC is deemed to have a low potential to affect soil and groundwater at the Site.

A diesel fuel UST release from a property located northeast of the Site was reported in October 1995. Approximately 100 cubic yards of petroleum impacted soil was removed. Exceedences of 2-methyl naphthalene in soil were detected above the applicable regulatory standards and a deed restriction consisting of an AUL was placed on the property along with a Class A-3 RAO in October 1996. Although ground water was not impacted, the ground water flow direction was determined to flow to the south-southwest toward the Site. Based on the proximity of the Site, the direction of ground water flow, and the implementation of an AUL indicating residual petroleum impacts are present, this REC is deemed to have a low potential to affect the Site.

PCBs were detected during the filling of an abandoned interceptor pipe with grout in soil in an area located northeast of the SiteBased on the proximity of this property to the Site and the lack of information available for review, this property is deemed a REC with low potential to impact the Site.

The Wamsutta layover site also has three potential environmental concerns, including:

- An electrical substation containing transformers abuts the Site to the west off Acushnet Avenue. It is not known if the transformers contain PCB transformer oil. The transformers have the potential to release transformer oil directly onto the ground surface.
- A motor repair facility abuts the Site to the east off Herman Melville Boulevard. Numerous 55-gallon drums were observed outside behind the facility facing the Site and most likely contained OHM. The drums were not placed on pallets or any other type of secondary containment structure. Releases or spills from the drums, should they occur, have the potential to impact the Site.
- Numerous piles of unused new creosote coated railroad ties were located in two areas in the northern portion of the Site. Creosote contains heavy organic compounds that have the potential to leach into soil and ground water.

The presence of these RECs and potential concerns will require additional Phase II site investigations to characterize soil and groundwater contamination, determine the extent of contamination, and evaluate the cost of remediation. Based on the Phase I investigation, the overall impacts of to site construction costs are ranked as "low" because this site is a capped landfill.

2.2.2.9 Cultural Resources

The Wamsutta Street Layover Facility is located on the east side of the New Bedford Main Line rail between Wamsutta Street and the proposed Whale's Tooth Station. The National Register Listed Wamsutta Mill Historic District (Map No. NB.D) and the recommended National Register eligible Revere Copper Products mill (Map No. NB.080) are both located about 400 feet to the north.

Historic Resources

The Wamsutta Street Layover Facility does not have any historic properties on the proposed site; therefore, there will be no direct impacts to historic resources.

The Wamsutta Layover Facility is located on the east side of the New Bedford Main Line rail between Wamsutta Street and the proposed Whale's Tooth Station. The Wamsutta Mill Historic District (Map No. NB.D) and the Revere Copper Products mill (Map No. NB.080) are both located within the APE . The introduction of a layover facility could have indirect visual and noise effects on the two nearby historic properties. Because the site is adjacent to the existing freight yard and will constitute an expansion of similar rail use, the visual impacts to the historic setting is likely to not be adverse. There will be no noise impacts to the adjacent historic industrial buildings, which are not a category of noise sensitive receptors under the FTA criteria. Vibration, traffic, atmospheric, and cumulative effects are anticipated to be minimal.

Archaeological Resources

The proposed Wamsutta Layover Facility in New Bedford is assessed as having high archaeological sensitivity for pre-contact/contact Native American habitation and resource procurement/processing sites and post-contact Euro-American domestic, commercial/wharves, and railroad-related structures and cultural deposits below the clean fill-geotextile composition cap.

The entire parcel is assessed as having a high archaeological sensitivity for pre-contact Native American habitation, resource procurement/processing sites, and documented post-contact Euro-American domestic, commercial/wharves, and railroad-related structures. This also includes cultural deposits within the Acushnet Avenue Waterfront Industrial historic area. The archaeologically sensitive strata are located below the capped Superfund site soils.

The current conceptual plan indicates that the proposed work will be contained within the existing disturbed railroad right-of-way/rail yard and capped Superfund site soils. Therefore, no project impacts to archaeological resources are anticipated.

2.2.2.10 Operational Constraints

The Wamsutta Site is located 0.3 miles north of the terminal station. As trains exit the layover facility they would be able to pull out onto a siding track separate from the New Bedford Main Line. By providing this additional track trains can pull out of the facility past a turnout south of the station and then turn around and enter the station. Due to the close proximity of the layover yard to the terminal station, there is minimal chance of there being a conflict between trains entering the layover facility and those entering the station.

2.2.2.11 Operations and Maintenance Costs

The Wamsutta layover facility is located 0.3 miles from the terminal station which is beneficial in that there would be minimal amounts of non-revenue miles traveled by each train in a given day. The cost per mile of service for the MBTA in 2010 was $11.92 based on the latest information provided by the National Transit Database. For each of the four eight-car trains to travel approximately 0.6 miles a day as non-revenue service to the Wamsutta site, the yearly operating cost for trains operating from this layover site alternative would be approximately $55,000.

Additional depreciation cost that would be incurred by having the layover facility far away from the terminal station is minimized for this alternative because of the close proximity of the layover facility to Whales Tooth Station.

2.3 Fall River Line

Three overnight layover sites were evaluated in the DEIS/DEIR: the ISP Site in Freetown, and two sites at Weavers Cove (Weavers Cove East and Weavers Cove West).

2.3.1 ISP Site

The proposed ISP site layover facility (Figure 2-3) would be constructed along the Fall River Secondary and would serve all rail alternatives. It would be located in Freetown west of Main Street between the existing Fall River Secondary and the Taunton River, approximately 5.3 miles north the southern terminus of the Fall River Secondary. This site is located on the west side of the right-of-way, opposite the existing ISP Facility, near milepost 47.1 in Freetown.

- Distance from Terminal – 5.3 miles north of Battleship Cove Station
- Lead Track – single lead track; potential for a long lead track or siding exists and can be assessed in FEIR

- Length of yard – 1,500 feet
- Width of yard – 180 feet
- Number of storage tracks – six tracks (typical); five tracks for anticipated trains with a spare plus one for future expansion and maintenance equipment
- Highway Access – 2440-foot driveway to south of layover on west side of right-of-way, new bridge or grade crossing across right-of-way at that point for 860-foot driveway to Horizon Way

2.3.1.1 Land Use and Acquistions

The ISP site consists of five undeveloped parcels surrounded by open space or other undeveloped land; an industrial facility is nearby to the northeast. A residential development is located less than 0.25-mile south this site. The Taunton River is immediately west of the site. Land uses and public or private ownership of the parcels that would be acquired to construct a layover facility at the ISP site are listed in Tables 2-10 and 2-11.

Table 2-10 Layover Facility at the ISP Site: Acquisition Parcel Land Uses

City/Town	Public Ownership		Private Ownership					
				Land Use Area (acres)				
	Number of Parcels	Area (acres)	Number of Parcels	Residential	Commercial	Industrial	Undeveloped	TOTAL
Freetown	0	0	5	0	0	0	43.57	43.57

Sources: MassGIS 2002, 2005; municipal data 2009, aerial mapping, and online research (various).

Table 2-11 Layover Facility at the ISP Site: Land Acquisition

Parcel Number	Ownership	Generalized Zoning	General Land Use	Property Tax Revenue Loss	Job Loss	Area (acres)	Percent Acquisition
234-2 (Freetown)	Private	Residential	Undeveloped	$362.78	No	11.03	100.0
235-9 (Freetown)	Private	Residential	Undeveloped	TBD	No	15.04	22.0
X-8-12 (Fall River)	Private	Residential	Undeveloped	$2,714.45	No	0.61	100.0
X-4-1 (Fall River)	Private	Industrial	Undeveloped	$10,189.67	No	10.53	100.0
X-4-22 (Fall River)	Private	Industrial	Undeveloped	$16,688.96	No	6.36	100.0
TOTAL				$29,955.86[1]		43.57	

Sources: MassGIS 2002, 2005; municipal data 2009, aerial mapping, and online research (various).
TBD: To be determined.
1: Additional property tax revenue losses may result from small and/or partial acquisitions that cannot be determined at this phase

The layover facility at the ISP site would require 43.57 acres (five parcels) of privately owned land. No residential, business, or community facility displacements would result from these acquisitions for the ISP site. The layover facility would make the portions not used for a layover inaccessible for future development, and would require complete acquisition of four of the five parcels.

Four of the parcels would be wholly acquired; property tax revenue losses for the Town of Freetown are estimated at $362.78 per year, and for the City of Fall River are estimated at $29,593.08 per year, in 2009 dollars. Less than 50 percent of parcel number 235-9 would be acquired and, accordingly, property tax revenue loss cannot be determined at this phase. Additional property tax revenue losses for the Town of Freetown could result from the partial acquisition.

The adjacent property, ISP Chemical is a chemical manufacturing plant which requires a high level of security, and which poses a risk in the event of a chemical accident. The operator of the facility has indicated that this land use is not compatible with an adjacent area where people may gather, or which has unrestricted access.

2.3.1.2 Environmental Justice

The ISP site is an undeveloped parcel surrounded by open space or other undeveloped land; an industrial facility is nearby to the northeast. A residential development is located less than 0.25-mile south of this site. The Taunton River is immediately west of the site. There are no environmental justice communities within 0.5 mile of the layover site. An analysis of direct or indirect impacts to environmental justice populations from constructing and using the ISP site layover facility was therefore not performed.

2.3.1.3 Noise Impacts

Noise at all of the proposed South Coast Rail layover facilities would be dominated by train’s idling locomotives. Trains that will remain at the layover facilities for one hour or longer will be shut down and attached to electrical power, as needed. The other minor noise sources on site are not expected to contribute to the overall sound levels and impacts. Distances to moderate and severe noise impacts at the layover facilities were calculated based on the Source Reference Level of 109 dBA at 50 feet as defined in FTA Guidelines. The layover facility sound level was projected to the receptor locations based on propagation of noise over distance. The existing sound levels, the project sound levels, and the number of impacts are shown in Table 2-12 No noise receptors would experience moderate or severe noise impacts at this location.

Table 2-12 ISP Layover Facility Sound Levels and Impacts

Location	Noise Exposure at 50' (Ldn)	Existing Noise Exposure (Ldn)	Moderate Impact Ldn	Moderate Impact Number of Impacts	Severe Impact Ldn	Severe Impact Number of Impacts
ISP	79.8	50	53.4	0	59.6	0

Assumptions:

- A Source Reference Level of 109 dBA at 50 from the center of the site for layover tracks was used (FTA Guidelines, Environmental Consequences Technical Report - Noise).
- All facilities are assumed to have one train idling per hour (day and night).

2.3.1.4 Wetlands and Waterways

The ISP layover facility site is located in Freetown and Fall River on the opposite side of the Fall River Secondary from the ISP chemical facility. This site is bounded to the north by forested uplands and forested wetlands, to the south and east by the Fall River Secondary, and to the west by the Taunton River and forested uplands. The site is best characterized as a mix between forested areas and open field. There are no wetland resources located on the site, though there is a vegetated wetland system located adjacent to it. No buffer zones extend onto the proposed layover facility site.

The site is currently undeveloped and largely forested. There is a pond east of the railroad right-of-way that is an impounded section of unnamed perennial stream. This stream crosses beneath the right-of-way in a culvert and flows through the wetland approximately 300 feet north of the facility before discharging to the Taunton River.

The proposed layover site would result in the permanent alteration of approximately 0.95 acres to Land Subject to Coastal Storm Flowage and temporary alteration of 0.16 acres. No impacts to Bank or bordering vegetated wetlands are anticipated. Development of this layover facility would temporarily impact 0.29 acres and would permanently impact approximately 2.28 acres of previously undeveloped Riverfront Area associated with the Taunton River.

2.3.1.5 Wild and Scenic Rivers

The Taunton River received a designation as a National Wild and Scenic River on March 30, 2009. The entire river system was included in this designation; from its headwaters at the confluence of the Town and Matfield Rivers in Bridgewater downstream 40 miles to the confluence with the Quequechan River at the I-195 Bridge in Fall River. The segment of the River where the ISP Layover Facility is proposed has been designated as a "recreational river area," recognizing its aesthetic value and developed shoreline under the Wild and Scenic Rivers program.

The layover facility would be visible from the Taunton River. As described above, this segment of the Taunton River has been designated as a "recreational river area," recognizing its aesthetic value and developed shoreline. No impacts to the Taunton River are anticipated that would jeopardize its National Wild and Scenic River recreational designation. The program does not prohibit development near designated rivers; rather it encourages regional river management practices to protect the use and enjoyment of these rivers. The design of the layover facility would be guided by land use and resource management objectives that are compatible with the river's classification.

2.3.1.6 Threatened and Endangered Species

According to the 2008 edition of the Natural Heritage Atlas and information from NHESP, there are no certified or potential vernal pools located on the property, nor is the property within Estimated or Priority Habitat of Rare Wildlife.

2.3.1.7 Chapter 91 and Coastal Zone

The ISP layover site is outside of the Coastal Zone and does not require work within filled tidelands.

2.3.1.8 Hazardous Materials

The ISP layover site is located between the railroad ROW and Barnaby Cove which is part of the Taunton River in the Town of Freetown. The land is currently undeveloped, except for a dirt pathway that traverses the property in a southwest-northeast orientation and the railroad tracks that abut the Site to the southeast. In a grassy area, several dirt roads are present and appear to be used by recreational vehicles. Based upon the tasks conducted for the Phase I ESA, five RECs associated with the Site were identified and are described in Table 2-13 and below.

Table 2-13 Summary of RECs at the Proposed ISP Layover Site

REC Description	Release Tracking Number (RTN)	Relative Impact
Documented Releases on or Encompassing the Layover Site	4-13482, 4-13856, and 4-15907	High
Existence of Large Quantity of Hazardous Chemicals and Existence of Risk Management Plan at Southwestern Adjoining Property (ISP Chemicals, 238 South Main Street)	Not applicable	High
Historic Use of Adjoining Properties	Not applicable	High
Documented Releases at Nearby Property (Former Synthetic Natural Gas Plant)	4-16971	Medium
Documented Releases at Southwestern Adjoining Property (238 South Main Street)	4-10219, 4-10965, 4-11891, 4-13804, 4-13805, 4-18988, 4-14027, 4-14485, 4-15568, 4-15700, 4-16479, 4-16533, 4-16702, 4-16703, 4-19297, and 4-19557	Medium

A total of 60 buried 55-gallon drums and contaminated soil were encountered during a due diligence test pit investigation in 1997. Impacted soil (80 tons) was removed and 6,300 cubic yards of soil was treated onsite by bioremediation and then returned to the excavation. Soil and ground water sampling revealed volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), EPH, and thallium above background levels. Fine white poly vinyl chloride (PVC) powder was observed in soil at a thickness of up to eight feet. Even though a Class A-2 RAO was achieved in December 1999, residual soil contamination and other buried materials may be present in this location.

Groundwater monitoring wells detected TCE, 1,1-dichloroethene and vinyl chloride above the applicable standards in 1997. The same compounds were detected in surface water collected from Barnaby Cove which is located downgradient of the Site. Response actions are currently ongoing. The documented releases in soil and ground water at the Site above the applicable standards constitute a REC which a high potential impact.

The adjoining ISP Freetown Fine Chemicals facility uses and stores over 58 chemicals. Because of the toxic nature of chemicals present at the ISP facility, EPA requires the preparation of a Risk Management Plan in the event of a release which could volatilize to the environment, impacting nearby receptors. According to the Risk Management Plan, the prevailing winds from the ISP facility were determined to be from the southeast to the northwest, toward the Layover Site. Because of the large quantity and the toxic nature of the chemicals used at the facility, if there were a release of toxic and volatile chemical(s), it would most likely impact potential receptors at the Layover Site. Therefore, the proximity, volume, and characteristics of these toxic and volatile chemicals have been deemed a REC with a high potential impact.

The following companies operated on the southwestern adjoining property at 238 South Main Street from 1964 to the present:

- Thompson Chemical Corporation,
- Continental Oil Corporation,
- Olin Corporation,
- Polaroid Corporation, and,
- ISP Freetown Fine Chemicals.

Therefore numerous quantities of OHM have been stored, treated, used, and/or disposed on this property since the 1960s, and on the former Algonquin Synthetic Natural Gas property since the 1970s. The historic uses of these properties, including the use of numerous OHM, is considered a REC with a high potential impact due to the potential for releases not previously identified to have occurred over the past 45 years of use; these releases could potentially migrate and affect the quality of soils and groundwater at the Site.

Algonquin Synthetic Natural Gas operated a synthetic natural gas plant approximately 1,000 feet to the north of the Site (currently a Stop and Shop Distribution facility) from 1973 and 1986. Petroleum constituents were detected in surficial soil samples and ground water at this property in 2000. A release of nickel and zinc was also identified in an area of the property adjoining the Site. These metals were generated from the associated catalyst usage in synthetic gas plant activities. In March 2003, one surficial soil sample was collected from an area located between the proposed Site and South Main Street and submitted for laboratory analysis of metals, VOCs, SVOCs, and herbicides. Nickel was detected at 160 mg/kg which exceeds the Method 1 S-1 standard of 20 mg/kg. Therefore, impacted soil may have migrated to the Site and may be encountered during construction of the proposed ISP Layover Site. The potential presence of impacted soil from the nearby former synthetic natural gas plant constitutes a REC with a medium potential impact.

Although numerous releases have occurred at the ISP Chemicals property located immediately southwest of the Layover Site, the majority of these releases were released to the air or achieved a Class A-1 or B-1 RAO, in which contamination approached or achieved background. Two of these releases achieved a Class A-2 RAO, in which contamination was not reduced to background; however, they both achieved No Significant Risk, and most likely did not migrate to or impact the

Layover Site. However, the quantity of the releases at the adjoining property constitutes a REC with a medium potential impact as unidentified or improperly assessed releases could exist.

The presence of these RECs and potential concerns will require additional Phase II site investigations to characterize soil and groundwater contamination, determine the extent of contamination, and evaluate the cost of remediation. Based on the Phase I investigation, the overall impacts of to site construction costs are ranked as “high”.

2.3.1.9 Cultural Resources

Cultural resources present at the ISP site include archaeological resources.

Historic Resources

No historic properties have been identified within the ISP Layover Facility site or in the APE; therefore there will be no impacts to historic resources.

Archaeological Resources

The proposed ISP Layover Facility in Freetown is assessed as having high archaeological sensitivity for pre-contact/contact Native American habitation and resource procurement/processing sites, which if present could be contributing elements to the Mother’s Brook Site (19-BR-106) within the Lower Taunton River Basin Archaeological District. There could also be under-documented post-contact period Euro-American agricultural-related cultural deposits. The site contains a recorded archaeological site (MHC #19-BR-106). There could also be under-documented post-contact period Euro-American agricultural-related cultural deposits.

The site is near the “Peace Haven” site in Freetown, identified as a significant cultural and archaeological resource. Another nearby site, part of the Mother Brook area, was identified at the proposed Meditech facility in Freetown. Development plans for that site were recently abandoned due to the cost and uncertainty of the archaeological investigations required by the Massachusetts Historic Preservation Office.

The current conceptual plan depicts construction activities within the sensitive areas. An intensive (locational) archaeological survey is needed to identify any archaeological sites. Project impacts would be assessed once the intensive survey is complete.

2.3.1.10 Operations

The ISP Layover Facility site is located in a section of the Fall River Secondary that is single tracked. This increases the possibility of operational conflicts between trains exiting the layover facility in the morning and trains leaving Battleship Cove and heading northbound. This would create additional operational conflicts from revenue service trains traveling southbound to Battleship Cove and trains traveling northbound from Battleship Cove to the layover facility. In the evening revenue service trains would need to wait for the non-revenue service trains to enter the layover facility before continuing southbound to Battleship Cove. Similarly in the morning trains exiting the layover facility heading towards Battleship Cove would need to wait in the double track section for the revenue service trains traveling northbound to pass.

2.3.1.11 Operations and Maintenance Costs

The ISP layover alternative is located approximately 5.3 miles north of the terminal station, Battleship Cove. Operating a layover facility 5.3 miles from the terminal station would result in 10.6 miles of deadheading each day for each of the four eight-car trains. Based on the MBTA's operating expense per vehicle mile of $11.92 determined by the latest information provided by the National Transit Database, it can be assumed that it would cost approximately $970,400 yearly to operate this layover facility alternative.

Additionally there is a depreciation cost associated with operating a layover facility 5.3 miles from the terminal station. The train's value would depreciate faster by adding 10.6 miles a day to each of the train's trips.

2.3.2 Weaver's Cove East

The proposed Weaver's Cove East site layover facility (Figure 2-4) would be constructed along the east side of the Fall River Secondary and would serve all rail alternatives. It would be located in Fall River west of Main Street between the existing Fall River Secondary and Main Street, approximately 2.6 miles north of the southern terminus of the Fall River Secondary. This site is located on the east side of the right-of-way, opposite the proposed Weaver's Cove LNG Site in Fall River, near milepost 49.8.

- Distance from Terminal – 2.6 miles north of Battleship Cove Station
- Lead Track – single lead track; potential for a long lead track or siding exists and can be assessed in FEIR
- Length of yard – 1,050 feet

- Width of yard – 200 feet
- Number of storage tracks – six tracks (typical); five tracks for anticipated trains with a spare plus one for future expansion and maintenance equipment
- Highway Access – 440-foot driveway to North Main Street

2.3.2.1 Land Use and Acquisitions

Currently vacant land, a portion of the Weaver's Cove East site was previously developed. Approximately one-half of the site is cleared of vegetation or includes remnant building foundations; the remainder of the site is vegetated. Surrounding land to the north, east, and south is residential; industrial land use is present to the southwest. Undeveloped land is immediately west of the site, adjoining the Taunton River. The industrial site to the southwest is a former Shell Oil facility, and consists of completely cleared land with several large aboveground storage tanks and a short shipping dock. Land uses and public or private ownership of the parcels that would be acquired to construct a layover facility at the Weaver's Cove site are listed in Tables 2-14 and 2-15.

Table 2-14 Layover Facility at the Weaver's Cove East Site: Acquisition Parcel Land Uses

City/Town	Public Ownership		Private Ownership					
				Land Use Area (acres)				
	Number of Parcels	Area (acres)	Number of Parcels	Residential	Commercial	Industrial	Undeveloped	TOTAL
Fall River	0	0	3	0.05	0	0	17.94	17.99

Sources: MassGIS 2002, 2005; municipal data 2009, aerial mapping, and online research (various).

Table 2-15 Layover Facility at the Weaver's Cove East Site: Land Acquisition

Parcel Number	Ownership	Generalized Zoning	General Land Use	Property Tax Revenue Loss	Job Loss	Area (acres)	Percent Acquisition
T-1-19	Private	Industrial	Residential	TBD[1]	No	0.05	38.5
T-1-33	Private	Industrial	Undeveloped	$42,129.43	No	13.80	100.0
T-1-38	Private	Industrial	Undeveloped	$15,188.32	No	4.14	100.0
TOTAL				$57,317.75		17.99	

Sources: MassGIS 2002, 2005; municipal data 2009, aerial mapping, and online research (various).
TBD: To be determined.
1: Additional property tax revenue losses may result from small and/or partial acquisitions that cannot be determined at this phase.

The layover facility at the Weaver's Cove East site would require 17.99 acres (three parcels) of privately owned land. No residential, business, or community facility displacements would result from these acquisitions for the Weaver's Cove East site.

The layover facility would make the undeveloped industrial portions not used for a layover unattractive for future development and would require complete acquisition of two of the three parcels.

Less than 50 percent of parcel number T-1-19 would be acquired and, accordingly, property tax revenue loss cannot be determined at this phase. Parcel numbers T-1-33 and T-1-38 would be wholly acquired; property tax revenue losses for the City of Fall River are estimated at $57,317.75 per year, in 2009 dollars. Additional property tax revenue losses could result from the partial acquisition.

The Weaver's Cove East site is not within or adjacent to any incompatible land use. The adjacent lands between the railroad and North Main Street are in residential or commercial use. There are no plans to change land uses or zoning in this area.

2.3.2.2 Environmental Justice

Although there are no environmental justice communities within the layover site, an EJ neighborhood is located south of the proposed layover facility, to the east of the Fall River Secondary. Residents living within this neighborhood meet low income criteria for designation. No parcels within an environmental justice neighborhood would be acquired for the Weaver's Cove East site layover facility. There would be no land acquisition impacts to environmental justice populations.

2.3.2.3 Noise Impacts

Noise at all of the proposed South Coast Rail layover facilities would be dominated by train's idling locomotives. Trains that will remain at the layover facilities for one hour or longer will be shut down and attached to electrical power, as needed. The other minor noise sources on site are not expected to contribute to the overall sound levels and impacts. Distances to moderate and severe noise impacts at the layover facilities were calculated based on the Source Reference Level of 109 dBA at 50 feet as per FTA Guidelines. The layover facility sound level was projected to the receptor locations based on propagation of noise over distance. The existing sound levels, the project sound levels, and the number of impacts are shown in Table 2-16. One residential receptor would experience moderate impacts.

Table 2-16 Weaver's Cove East Layover Facility Sound Levels and Impacts

Location	Noise Exposure at 50' (Ldn)	Existing Noise Exposure (Ldn)	Moderate Impact		Severe Impact	
			Ldn	Number of Impacts	Ldn	Number of Impacts
Fall River - Weaver's Cove Sites (East or West)	79.8	55	55.3	1	61.2	0

Assumptions:

- A Source Reference Level of 109 dBA at 50 from the center of the site for layover tracks was used (FTA Guidelines, Environmental Consequences Technical Report - Noise).
- All facilities are assumed to have one train idling per hour (day and night).

2.3.2.4 Wetlands and Waterways

Two wetland resources were originally mapped on the property consisting of scrub shrub wetlands: Wetland FA-5C and Wetland FA-5D. Wetland FA-5D is located in a depression that formerly held an above ground storage tank. During the review of the Abbreviated Notice of Resource Area Delineation by the Fall River Conservation Commission, the Commission determined that Wetland FA-5C was not a jurisdictional wetland. Wetland FA-5D is not subject to jurisdiction under the Massachusetts Wetland Protection Act. The Taunton River is within 100 feet of the proposed site but is separated from the site by the Fall River Secondary. As a result of these regulatory determinations by the Fall River Conservation Commission, in their Order of Resource Area Delineation, it was determined that the proposed layover site would not impact jurisdictional bordering vegetated wetlands. No impacts to Bank, bordering vegetated wetlands, Riverfront Area (25 feet within the City of Fall River), or Land Subject to Coastal Storm Flowage are anticipated at this site.

2.3.2.5 Wild and Scenic Rivers

The Taunton River received a designation as a National Wild and Scenic River on March 30, 2009. The entire river system was included in this designation; from its headwaters at the confluence of the Town and Matfield Rivers in Bridgewater downstream 40 miles to the confluence with the Quequechan River at the Interstate 195 Bridge in Fall River. The segment of the River where the Weaver's Cove East Layover Facility is proposed has been designated as a "recreational river area," recognizing its aesthetic value and developed shoreline under the Wild and Scenic Rivers program.

The layover facility would be visible from the Taunton River. As described above, this segment of the Taunton River has been designated as a "recreational river area," recognizing its aesthetic value and developed shoreline. No impacts to the Taunton River are anticipated that would jeopardize its National Wild and Scenic River recreational designation. The program does not prohibit development near designated rivers; rather it encourages regional river management practices to protect the use and enjoyment of these rivers. The design of the layover facility would be guided by land use and resource management objectives that are compatible with the river's classification.

2.3.2.6 Threatened and Endangered Species

According to the 2008 edition of the Natural Heritage Atlas and information from NHESP, there are no certified or potential vernal pools located on the property, nor is the property within Estimated or Priority Habitat of Rare Wildlife.

2.3.2.7 Chapter 91 and Coastal Zone

Informal consultation with DEP Waterways staff indicated that the Department presumes that the Weaver's Cove East layover facility is located within filled tidelands. This jurisdiction was not expected because the existing site is approximately 20 feet in elevation above the shoreline of the Taunton River. This presumed jurisdictional boundary is based on the shoreline shown on two historic maps provided by the DEP prepared in 1865 and 1874. Both of these maps postdate the construction of the railroad. It is likely that the railroad impounded water in the vicinity of the proposed layover facility and this impoundment is represented on these historic maps. If the presumption is true, the construction of the proposed layover facility will require a new Chapter 91 license. The Waterways Regulations are designed to protect and promote the public's interest in tidelands through the inclusion of provisions to conserve the capacity for water-dependent uses. The use of the site for layover needs is expected to be classified by DEP as a nonwater-dependent Infrastructure Facility (310 CMR 9.55). This classification may waive some of the above-referenced provisions, as long as feasible mitigation or compensation measures are provided such as the protection of maritime commerce or recreation and associated public access, reduction of flood and erosion-related hazards on lands subject to the 100-year flood or projected sea level rise, and the attainment of water quality goals.

The layover facility would be located entirely within the coastal zone associated with the Taunton River but outside the Mount Hope Bay DPA. Accordingly, the proposed layover facility would require a Federal Consistency Certification under the MCZMP. Preliminary consultation with representatives of the MCZMP indicates that the proposed facility would likely be determined to be consistent with the regulatory policies of the MCZMP.

2.3.2.8 Hazardous Materials

The Weaver's Cove East Layover site consists of three parcels and is located between the railroad tracks which are located to the west and North Main Street which is located to the east in a mixed use area of Fall River. The former Shell Oil Company petroleum product distribution facility is located southwest of the railroad tracks. The Weaver's Cove portion of the Taunton River is located immediately west and northwest of the railroad tracks. The parcels comprising the site are currently undeveloped and surrounded by a chain-link fence. Groundwater monitoring wells were observed throughout the site.

The southernmost parcel (Parcel T-1-38) consists of a concrete slab from a former repair garage that was used by the New England Telephone & Telegraph company. The land around the slab consists of grass, shrubs and trees. The center parcel (Parcel T-1-33) consists of a heavily vegetated wetland area that reportedly was formed from a depression caused by the weight of a former gasoline aboveground storage tank. The northernmost parcel (Parcel T-15-1) is vegetated and primarily covered with shrubs and trees.

Based on the tasks conducted for the Weaver's Cove East Layover site Phase I ESA, five RECs and one potential environmental concern were identified and are described below and in Table 2-17.

Table 2-17 Summary of RECs at the Proposed Weaver's Cove East Layover Site

REC Description	Release Tracking Number (RTN)	Relative Impact
Previous Use of Site as Oil Storage Facility and Documented Petroleum Release on Site	4-749	High
Previous Use of Adjoining Property as Petroleum Product Distribution Facility and Documented Release (Shell Oil Company, 1 New Street)	4-749	High
Previous Use of Building on Parcel T-1-38 as Commercial Garage	Not applicable	Medium
Existence of Underground Storage Tanks (USTs) on Parcel T-1-38	Not applicable	Medium
Possible Presence of Elevated Concentrations of Metals in Site Soil	Not applicable	Low

According to historic Sanborn maps, from the early to mid 1900s, a large gasoline AST was located on the center portion of the Site and was removed in the mid-1900s. According to documents reviewed, Shell operated a crude oil refinery, product storage and distribution facility at the western abutting property from 1920 to 1929 and a petroleum product distribution facility from 1929 to 1995.

Documents obtained from the Fall River Fire Department depict a large area of petroleum impacts, which includes the Site and the abutting property located west of the

Site, as well as the former and current tank locations. Contours on the map show the thickness of the light non-aqueous phase liquids (LNAPL) in ground water of thickness up to 2.5 feet. In the center of the Site, the LNAPL thickness is shown to be two feet. The previous use of the Site as an oil storage facility and the documented extensive petroleum release constitutes a REC with a high potential impact.

Shell operated a crude oil refinery, product storage and distribution facility at the western abutting property (Weaver's Cove West) from 1920 to 1929 and a petroleum product distribution facility from 1929 to 1995. According to documents reviewed, extensive petroleum releases occurred on that property during that time. This property is currently being remediated with a LNAPL recovery and ground water treatment system. Even though active remediation activities are currently ongoing and ground water flows to the northwest toward the Taunton River and away from the Site, the presence of extensive LNAPL in the subsurface is deemed a REC with a high potential impact.

Recent aerial photographs of the southern portion Site located on Parcel T-1-38 show the presence of a concrete slab, indicating that a building was once present. A Sanborn map dated 1976 shows the existence of a "private garage" that was operated by New England Telephone and Telegraph Company. Vehicle repairs were likely performed in this building and petroleum and other OHM including motor oil, waste oil, fuel oil, alcohol, anti-freeze, and degreasing chemicals that may contain chlorinated solvents were likely to have been stored, used, and generated. The storage, use, and/or generation of these products may have or could result in a release of OHM constituting a REC with a medium potential impact.

According to records received from the Fall River Fire Prevention Department, three USTs were previously located on Parcel T-1-38, 2680 North Main Street. The records document the removal of the gasoline and waste oil tanks which were removed in 1988 and 1987, respectively. There are no records documenting the removal of the No. 6 fuel oil tank. It was not indicated on the removal records if contamination was encountered during the removal of the gasoline and waste oil tanks and detailed closure reports were not identified. Therefore, OHM may be present in the locations of the former USTs. In addition, it is possible that the No. 6 fuel oil UST, the integrity of which is unknown, may still be present. OHM associated with the USTs formerly/currently on this property would constitute a REC with a medium potential impact.

According to a report reviewed for a western adjoining property (1 New Street), arsenic and beryllium were detected in soil above applicable standards at a depth beginning from the ground surface to a depth of approximately eight feet below grade. The detection of these metals are believed to be attributable to historic filling activities in the 1920s during which fill material was dredged from the Taunton River. The potential presence of OHM at levels which could pose a risk to human or ecological populations is considered a REC with a low potential impact and would need to be managed appropriately during any proposed construction activities.

Weaver's Cove East Layover site has one potential environmental concern. During the site reconnaissance, pole-mounted electrical transformers were observed on the Site. It is not known if these transformers contain PCB transformer oil. The transformers have the potential to leak transformer oil directly onto the ground surface.

The presence of these RECs and potential concerns will require additional Phase II site investigations to characterize soil and groundwater contamination, determine the extent of contamination, and evaluate the cost of remediation. Based on the Phase I investigation, the overall impacts of to site construction costs are ranked as "medium" to "high".

2.3.2.9 Cultural Resources

The historic survey completed for the Weaver's Cove layover facility parcel on the west side of the railroad right-of-way encompasses the historic resources in the APE of the current site on the east side of the right-of-way.

Historic Resources

Based on the survey completed for the west site, the Weaver's Cove East site overlaps into a portion of the North Main Street Area (Map No. FR.D) that has been recommended as eligible for the National Register. This part of the Area has no buildings. The construction of the layover facility would be an adverse effect as it would change the visual setting and the character of the area.

Two historic properties are located in the layover facility APE: the National Register-listed Squire William B. Canedy House (Map No. FR.012) and the National Register-eligible William J. Wiley Middle School (Map No. FR.013).

The William B. Canedy House would be separated from the layover facility by a modern building and outbuildings, and then by the tracks. There would be no adverse visual impact because the layover facility would not substantially alter the historic setting of the house, which is already converted to industrial uses (i.e. the tank farm). There would be no noise impacts that would require modifications to the building and no land acquisition from the property.

The William J. Wiley Middle School is located on the opposite (east) side of Main Street from the facility and separated from it by this major roadway and several modern buildings. There would be no property acquisition, no change in the setting of the school, and no noise impacts that would require modifications to the exterior of the building.

There will be no adverse effect to the nearby National Register-listed Squire William B. Canedy House and the National Register-eligible William J. Wiley Middle School.

Archaeological Resources

The project parcel on the west side of the railroad right-of-way within the proposed Weaver's Cove LNG Site was previously subjected to an archaeological reconnaissance survey in 2003. No areas of archaeological sensitivity were identified in the previously disturbed parcel, and no further work was deemed necessary.

The project parcel on the east side of the railroad right-of-way opposite the Weaver's Cove LNG Site has not been subjected to archaeological reconnaissance survey. An archaeological reconnaissance survey is needed to assess the archaeological sensitivity of this parcel. An intensive (locational) survey may be needed to identify archaeological sites in sensitive areas. Project impacts to archaeological resources for the Weaver's Cove East parcel will be assessed prior to completion of environmental review and when more design information is available.

2.3.2.10 Operations

The Weaver's Cove East site is located in a section of the Fall River Secondary that is single track. Since this site is located on the eastern side of the tracks there may be conflicts in the morning if trains heading northbound from Battleship Cove; however, there is a minimal chance of conflict in the morning because of the 40-minute headway allotted to each train. A similar opportunity for conflicts occurs in the evening with trains heading northbound from Battleship Cove to the layover facility. If these trains experience any significant delays that would require the revenue service trains heading southbound to wait prior to entering the single track section until the train heading to the layover facility clears the area.

2.3.2.11 Operations and Maintenance Costs

The Weavers Cove East site is located 2.6 miles north of Battleship Cove. In order to operate from this facility all four eight-car trains would need to travel these 2.6 miles to and from Battleship Cove as non-revenue service trains. Operating a layover facility 2.6 miles from the terminal station would result in 5.2 miles of deadheading each day for each of the four eight-car trains. Based on the MBTA's operating expense per vehicle revenue mile of $11.92 determined by the latest information provided by the National Transit Database, it can be assumed that it would cost approximately $476,000 yearly to operate trains our of this layover facility.

Additionally these are costs associated with the depreciation of the equipment by requiring an additional 5.2 miles of travel to and from the layover facility each day.

2.3.3 Weaver's Cove West

The proposed Weaver's Cove West site layover facility (Figure 2-5) would be constructed along the west side of the Fall River Secondary Line. The facility would be between the existing Fall River Secondary and the Taunton River, approximately 2.6 miles from the southern terminus of the Fall River Secondary. This site is located on the west side of the right-of-way, on the proposed Weaver's Cove LNG Site in Fall River, near milepost 49.8.

- Distance from Terminal – 2.6 miles north of Battleship Cove Station
- Lead Track – single lead track; potential for a long lead track or siding exists and can be assessed in FEIR
- Length of yard – 1,100 feet
- Width of yard – 200 feet
- Number of storage tracks – six tracks (typical); five tracks for anticipated trains with a spare plus one for future expansion and maintenance equipment
- Highway Access – direct access to site off of New Street

2.3.3.1 Land Use and Acquisition

The site is zoned as General Industrial by the City of Fall River. The site includes both developed and undeveloped land. The developed portion is highly disturbed by industrial uses associated with a petroleum products facility. The industrial site is a former Shell Oil facility, and consists of completely cleared land with several large aboveground storage tanks and a short shipping dock. The undeveloped portion is vegetated. Approximately seven acres of the Shell site, primarily the undeveloped portion, would be utilized for the proposed layover facility. Surrounding land in all directions except west and northwest is similarly undeveloped or industrial property. A narrow strip of lightly developed land (a cell phone tower site) is northwest of the site.

Portions of parcels that would be acquired to construct a maintenance/layover facility at the Weaver's Cove site are listed in Table 2-18.

Table 2-18 Layover Facility at the Weaver's Cove West Site: Land Acquisition

Parcel Number	Ownership	Generalized Zoning	General Land Use	Property Tax Revenue Loss	Job Loss	Area (acres)	Percent Acquisition
T-2-1	Private	Industrial	Industrial	TBD	No	48.74	100
T-15-2	Private	Industrial	Undeveloped	TBD	No	9.17	100
TOTAL				TBD		57.91	

Sources: MassGIS 2002, 2005; municipal data 2009, aerial mapping, and online research (various).
TBD: To be determined.

The layover facility would require the acquisition of approximately 57.91 acres (two parcels) of privately owned land, both zoned for industrial uses; one is undeveloped while the other was used as part of a currently inactive petroleum products facility as discussed in Section 2.3.7. The layover facility would make the portions not used for a layover inaccessible for future development and would require the complete acquisition of these parcels.

Property tax revenue and job losses could result from acquisition of the two privately-owned parcels at the site. However, precise revenue losses cannot be determined, as current property tax revenue information is not available at this time.

The Weaver's Cove West site is within the area formerly proposed for use as a liquefied natural gas facility, and owned by Hess. There is currently no proposal for an alternative development on this site, however the City of Fall River has convened a task force to identify potential future uses if the City were to acquire the property. Because of the preliminary nature of this planning effort, MassDOT anticipates that layover facility would be compatible with future land uses.

2.3.3.2 Environmental Justice

Although there are no Environmental Justice (EJ) communities within the layover site, an EJ neighborhood is located southeast of the proposed layover facility; to the east of the Fall River Secondary. Residents living within this neighborhood meet low income criteria for this designation. No parcels within an environmental justice neighborhood would be acquired for the Weaver's Cove West site layover facility. There would be no land acquisition impacts to environmental justice populations. There are no disproportionate impacts to this community for noise, visual or air quality impacts.

2.3.3.3 Noise Impacts

Noise at all of the proposed South Coast Rail layover facilities would be dominated by train's idling locomotives. Trains that will remain at the layover facilities for one hour or longer will be shut down and attached to electrical power, as needed. The other minor noise sources on site are not expected to contribute to the overall sound levels and impacts. Distances to moderate and severe noise impacts at the layover facilities were calculated based on the Source Reference Level of 109 dBA at 50 feet as per FTA Guidelines. The layover facility sound level was projected to the receptor locations based on propagation of noise over distance. This analysis revealed only one impact, which occurred at both the proposed Weaver's Cove East and West facilities. The existing sound levels, the project sound levels, and the number of impacts are shown in Table 2-19. One residential receptor would experience a moderate noise impact.

Table 2-19 Weaver's Cove West Layover Facility Sound Levels and Impacts

			Moderate Impact		Severe Impact	
Location	Noise Exposure at 50' (Ldn)	Existing Noise Exposure (Ldn)	Ldn	Number of Impacts	Ldn	Number of Impacts
Fall River - Weaver's Cove Sites (East or West)	79.8	55	55.3	1	61.2	0

Assumptions:

- A Source Reference Level of 109 dBA at 50 from the center of the site for layover tracks was used (FTA Guidelines, Environmental Consequences Technical Report - Noise).
- All facilities are assumed to have one train idling per hour (day and night).

2.3.3.4 Wetlands

There are no vegetated wetland resources located on the site, though a portion of Land Subject to Coastal Storm flowage associated with the Taunton River is located in the northeast portion of the proposed layover facility site. The sections of the site that are not currently used by the oil facility, located on the eastern portion of the proposed facility, are characterized as scrub shrub uplands. The site includes Land Subject to Coastal Storm Flowage associated with the Taunton River, which is regulated by the Wetlands Protection Act. These areas are subject to flood inundation caused by coastal storms up to and including that caused by the 100-year storm.

The Taunton River is located less than 50 feet from the main portions of the proposed Weaver's Cove West Facility site. No other surface water resources exist on, or adjacent to, the site. There are no groundwater drinking water source protection resources on or adjacent to the site.

The proposed Weaver's Cove West layover would include construction within a small segment of Land Subject to Coastal Storm Flowage associated with the Taunton River. Flood hazard management measures should be included in the layover design (e.g., stormwater management for the 100-year storm, placement of oil and grease collection trays and separators outside of this area).

2.3.3.5 Wild and Scenic Rivers

The Taunton River received a designation as a National Wild and Scenic River on March 30, 2009. The entire river system was included in this designation; from its headwaters at the confluence of the Town and Matfield Rivers in Bridgewater downstream 40 miles to the confluence with the Quequechan River at the Interstate 195 Bridge in Fall River. The segment of the River where the Weaver's Cove West Layover Facility is proposed has been designated as a "recreational river area," recognizing its aesthetic value and developed shoreline under the Wild and Scenic Rivers program.

The layover facility would be visible from the Taunton River. As described above, this segment of the Taunton River has been designated as a "recreational river area," recognizing its aesthetic value and developed shoreline. No impacts to the Taunton River are anticipated that would jeopardize its National Wild and Scenic River recreational designation. The program does not prohibit development near designated rivers; rather it encourages regional river management practices to protect the use and enjoyment of these rivers. The design of the layover facility would be guided by land use and resource management objectives that are compatible with the river's classification.

2.3.3.6 Threatened and Endangered Species

According to the 2008 edition of the Natural Heritage Atlas and information from Natural Heritage and Endangered Species Program, there are no Certified or Potential Vernal Pools located on the property, nor is the property within Estimated or Priority Habitat of Rare Wildlife.

2.3.3.7 Chapter 91 and Coastal Zone

Approximately 4,300 sq. ft. of land within the northeast section of the Weaver's Cove West layover facility area is presumed to contain filled tidelands, subject to jurisdiction under Massachusetts General Law, Chapter 91 and accompanying Waterways Regulations at 310 CMR 9.00 (Figure 2-2). The Massachusetts Department of Environmental Protection (DEP) has created a series of presumed jurisdictional boundaries based on the shoreline shown on two historic maps prepared in 1865 and 1874. Jurisdiction is presumed versus confirmed due to the incompleteness of the data and DEP reserves the right to make determinations on a case-by-case basis. The

Waterways Regulations, administered by DEP, are designed to protect and promote the public's interest in tidelands through the inclusion of provisions to conserve the capacity for water-dependent uses.

The proposed site is located entirely within the jurisdictional Coastal Zone boundaries (Taunton River Estuary Coastal Zone). Accordingly, the proposed layover facility would require a Federal Consistency Certification by the Massachusetts Office of Coastal Zone Management (MCZM).

Human-induced coastal resources include a portion of the Mount Hope Bay (Fairhaven/New Bedford) Designated Port Area (DPA). DPAs are marine industrial land and water areas protected by regulation to preserve and the Commonwealth's marine economy. In terms of human-induced resources, the proposed facility is consistent with DPA temporary uses and would not affect the operations of the Mount Hope Bay DPA. EOT expects the layover facility project to be found consistent with MCZM program policies based on its minimal impacts and strategies for meeting applicable coastal regulations. The use of the site for a layover facility is expected to be classified by DEP as a Nonwater-dependent Infrastructure Facility (310 CMR 9.55), which may waive some of the Waterways regulatory provisions, as long as feasible mitigation or compensation measures are provided such as the protection of maritime commerce or recreation and associated public access, reduction of flood and erosion-related hazards on lands subject to the 100-year flood or projected sea level rise, and the attainment of water quality goals.

Public access to the water is limited, due to the industrial nature of the site and partial location within the DPA. However, there are some areas of the site where informed public access seems to be achieved, namely the northernmost vegetated portion via a series of pathways off of North Main Street. This public access may be restricted upon construction of the layover facility.

2.3.3.8 Hazardous Materials

Based on the tasks conducted for the proposed Weaver's Cove West Phase I Environmental Site Assessment (ESA), three Recognized Environmental Conditions (RECs) and two potential environmental concerns were identified and are described below and in Table 2-20.

Table 2-20 Summary of RECs at the Proposed Weaver's Cove West Layover Site

REC Description	RTN(s)	Relative Impact
Existence of USTs and ASTs at Site	Not applicable	High
Previous Use of Site as Petroleum Products Distribution Facility and Documented Release	4-749	High
Possible Presence of Elevated Concentrations of Metals in Site Soil	Not applicable	Low

According to the DEIS/DEIR, a total of 12 gasoline, fuel oil, and used oil tanks ranging in size from 1,000 gallons to 15,000 gallons were removed from the site from 1989 to 1998. A Certificate of Registration dated April 25, 2002 to Jay Cashman, Inc. at One New Street, the address of the site, grants the “keeping, storage, manufacture or sale of flammables or explosives as follows: 64,000,000 gallons of various petroleum products”. A UST inventory notification dated May 1991 stated that eight USTs were located at the Site. Six of the USTs were listed as being permanently out of use and two of the USTs were listed as being currently in use. The size of the USTs or the type of product was not provided. The tank removal records list only six USTs having been removed since 1991. It was not indicated on the tank removal records if contamination was encountered during the removal and detailed closure reports were not identified. Therefore, oil and/or hazardous material (OHM) may be present in the locations of the former USTs. In addition, it is possible that at least two USTs, the integrity of which is unknown, may still be present. OHM associated with the USTs and ASTs that were formerly and currently may be present on this property would constitute a REC.

Shell operated a crude oil refinery, product storage and distribution facility on the site from 1920 to 1929 and a petroleum product distribution facility on the site from 1929 to 1995. According to documents reviewed, extensive petroleum releases occurred on the site during that time. A map of the depicts a large area of petroleum impacts, as well as the former and current tank locations. Contours on the map show the thickness of the light non-aqueous phase liquid (LNAPL) in groundwater at the site with thicknesses up to 2.5 feet. According to a recent Remedy Operation Status (ROS) Status Report dated November 2008, this property is currently being remediated with a LNAPL recovery and groundwater treatment system. The previous use of the site as an oil storage facility and the documented extensive petroleum release constitutes a REC.

According to a report reviewed for the property, arsenic and beryllium were detected in soil above applicable standards at a depth beginning from the ground surface to a depth of approximately eight feet below grade. The potential presence of OHM at levels which could pose a risk to human or ecological populations is considered a REC and would need to be managed appropriately during any proposed construction activities.

Even though not considered RECs, the following is considered to be a potential environmental concern: During the site reconnaissance, pole-mounted electrical transformers were observed on the site. It is not known if these transformers contain polychlorinated biphenyl (PCB) transformer oil. The transformers have the potential to leak transformer oil directly onto the ground surface.

The presence of these RECs and potential concerns will require additional Phase II site investigations to characterize soil and groundwater contamination, determine the extent of contamination, and evaluate the cost of remediation. Based on the Phase I investigation, the overall impacts of to site construction costs are ranked as “high”.

2.3.3.9 Cultural Resources

No previously reported historic sites or structures are located within the boundaries of the Weaver's Cove West Layover facility.

Historic Resources

One previously reported historic structure referenced by Adams et al. (2009) FR.015 (MHC No. FLR.485) is located within the 400-foot wide study buffer for the proposed facility location. The Border City Mill No. 2 building; 1 Weaver Street is about 400 feet southwest of the southern end of the layover facility. As described by Adams et al. (2009:22) the "mill is a five-story, Italianate style brick mill loft with an exterior stair tower. The structure was designed by Josiah Brown, Fall River's first professional architect, and constructed in 1873 for the manufacture of worsted woolens, print cloth, sheeting, and shirting." The mill is an element of the Fall River Multiple Resource Area, which encompasses all of Fall River within the city limits, and is an individually listed property on the National Register of Historic Places.

Two other resources adjacent to the site were identified during the reconnaissance survey. These are referenced by Adams et al. (2009) as FR.A (the Fall River Branch Railroad Corridor) and FR.014 (21 Alton Street). The railroad corridor forms the eastern boundary of the Weaver's Cove West layover facility. FR.014 is immediately adjacent to the railroad line and on the east side of the railroad corridor. The residence at 21 Alton Street is a vernacular structure constructed about 1870. Neither the railroad corridor nor the residence was recommended as eligible to the National Register of Historic Places by Adams et al. (2009).

Although some historic resources were identified on sites adjacent to the proposed layover facility; no adverse impacts to these sites are anticipated. These historic structures are simply too far from the layover facility to be impacted by construction or operations of the facility. It is highly unlikely that any construction debris and/or particulate matter would reach these locations. Furthermore, no noise or vibration impacts were recorded at the historic sites.

Archaeological Resources

Past archeological studies completed for the Weaver's Cove Energy LNG Terminal project, located in the same area as the proposed Weaver's Cove West layover facility, showed that there are no archeological resources within the site.

2.3.3.10 Operations

The Weavers Cove West layover facility would be located on the west side of the single track section on the Fall River Secondary. There is a minimal chance of conflict in the morning because of the 40-minute headway allotted to each train. If a train leaving Battleship Cove was delayed in the morning then the next train exiting the layover facility would need to wait to enter the single track section until the other train passes. Similarly in the evening if a non-revenue service train were heading northbound to the layover facility and had been delayed, the revenue service train heading southbound would need to wait before the layover facility

2.3.3.11 Operations and Maintenance Costs

The Weavers Cove West site is located 2.6 miles north of Battleship Cove. In order to operate from this facility all four eight-car trains would need to travel these 2.6 miles to and from Battleship Cove as non-revenue service trains. Operating a layover facility 2.6 miles from the terminal station would result in 5.2 miles of deadheading each day for each of the four eight-car trains. Based on the MBTA's operating expense per vehicle revenue mile of $11.92 determined by the latest information provided by the National Transit Database, it can be assumed that it would cost approximately $476,000 yearly to operate trains out of this layover facility.

Additionally these are costs associated with the depreciation of the equipment by requiring an additional 5.2 miles of travel to and from the layover facility each day.

2.4 Summary

This section summarizes environmental impacts and compares the sites on each branch.

2.4.1 Land Use and Acquisitions

Land acquisition could range from 11 acres (Wamsutta) to 39 acres (Church Street) on the New Bedford line, and from 18 acres (Weaver's Cove East) to 58 acres (Weaver's Cove West) on the Fall River line, as shown in Table 2-21. Land acquisition totals required for each site range due to the shape of the sites and how a layover facility would dissect them. If the layover dissects a site in a way that would make access and any future development infeasible on the remaining section of the site, it was assumed that the project would need to acquire the entire site rather than just a percentage.

Table 2-21 Summary of Layover Facility Land Acquisition

Site	Public Ownership Area in acres (number of parcels)	Private Ownership Land Use Area in acres (number of parcels)				
		Residential	Commercial	Industrial	Undeveloped	*Total*
Church Street Site	0	0	0	9.18 (1)	29.63 (1)	*38.81 (2)*
Wamsutta Site	11.02 (1)	0	0	0	0	*0*
ISP Site	0	0-	0-	0	43.57 (5)	*43.57 (5)*
Weaver's Cove East Site	0	0.05 (1)	0	0-	17.94 (2)	*17.99 (3)*
Weaver's Cove West Site	0	0	0	48.74 (1)	9.17 (1)	*57.91 (2)*

Tax effects of the layover site alternatives are listed in Table 2-22. Depending on the alternative selected, tax losses in New Bedford would range from zero to $21,378, while tax losses in Fall River would range from $29,956 to $57,318.

Table 2-22 Summary of Layover Facility Potential Effects to the Economic Environment

Candidate Layover Facility Site	Property Tax Revenue Loss[1]	Job Loss
Church Street Site	$21,378.34	Yes[2]
Wamsutta Site	$0.00	No
ISP Site	$29,955.86[3]	No
Weaver's Cove East Site	$57,317.75[3]	No
Weaver's Cove West Site	NA[4]	No

NA: Not available
1 Does not include partial takings
2 Job losses at the recycling facility are expected but have not been quantified.
3 Full extent of tax revenue loss has not been determined for this site acquisition; additional property tax revenue losses may result from small and/or partial acquisition that cannot be determined at this phase.
4 Tax loss has not been determined as current property tax revenue information was not available when this analysis was conducted.

2.4.2 Environmental Justice

None of the layover facilities on either the New Bedford or Fall River lines would result in impacts to environmental justice populations.

2.4.3 Noise

Noise at the proposed South Coast Rail layover facilities would be dominated by trains idling locomotives. Trains that will remain at the layover facilities for one hour or longer will be shut down and attached to electrical power, as needed. The other minor noise sources on site are not expected to contribute to the overall sound levels and impacts. Distances to moderate and severe impact at the layover facilities were calculated based on the Source Reference Level of 109 dBA at 50 per FTA Guidelines. The existing sound levels, the project sound levels, and the number of impacts are shown in Table 2-23. Moderate noise impacts would occur at the Weaver's Cove East and West sites.

Table 2-23 Layover Facilities Sound Levels and Impacts

			Moderate Impact		Severe Impact	
Location	Noise Exposure at 50' (Ldn)	Existing Noise Exposure (Ldn)	Ldn	Number of Impacts	Ldn	Number of Impacts
Church Street Site	79.8	55	55.3	0	61.2	0
Wamsutta Site	79.8	60	57.8	0	63.4	0
ISP Site	79.8	50	53.4	0	59.6	0
Weaver's Cove East	79.8	55	55.3	1	61.2	0
Weaver's Cove West	79.8	55	55.3	1	61.2	0

Assumptions:

- A Source Reference Level of 109 dBA at 50 from the center of the site for layover tracks was used (FTA Guidelines - Table 5-5).
- All facilities are assumed to have one train idling per hour (day and night).

2.4.4 Wetlands

The Church Street, ISP, Weaver's Cove East, and Weaver's Cove West sites have mapped wetland resources located on the property and are listed below in Table 2-24. Although the Wamsutta site is within 100 feet of a jurisdictional wetland, it would not impact this wetland. The Church Street site would impact approximately 0.1 acre of wetlands. On the Fall River line, no vegetated wetland impacts would be required at any site.

Table 2-24 Direct Wetland Impacts – Layover Facilities

Layover	Bank (lf)		BVW (ac)		Land Subject to Coastal Storm Flowage (ac)	
	Permanent	Temporary	Permanent	Temporary	Permanent	Temporary
Church Street	0	0	0.07	0.06	0	0
Wamsutta Site	0	0	0	0	0	0
ISP Site	0	0	0	0	0.95	0.16
Weavers Cove East	0	0	0	0	0	0
Weavers Cove West	0	0	0	0.04	0	0

2.4.5 Wild and Scenic Rivers

Neither of the proposed layover facilities on the New Bedford line would affect a Wild and Scenic River.

Each of the three proposed layover facilities on the Fall River line would be adjacent to and visible from the Taunton River. The Taunton River received a designation as a National Wild and Scenic River on March 30, 2009. The entire river system was included in this designation; from its headwaters at the confluence of the Town and Matfield Rivers in Bridgewater downstream 40 miles to the confluence with the Quequechan River at the Interstate 195 Bridge in Fall River. The segment of the River where the Weaver's Cove West Layover Facility is proposed has been designated as a "recreational river area," recognizing its aesthetic value and developed shoreline under the Wild and Scenic Rivers program.

As described above, this segment of the Taunton River has been designated as a "recreational river area," recognizing its aesthetic value and developed shoreline. No impacts to the Taunton River are anticipated that would jeopardize its National Wild and Scenic River recreational designation. The program does not prohibit development near designated rivers; rather it encourages regional river management practices to protect the use and enjoyment of these rivers. The design of the layover facility would be guided by land use and resource management objectives that are compatible with the river's classification.

2.4.6 Threatened and Endangered Species

None of the layover sites evaluated would affect state-listed threatened or endangered species, or species of special concern.

2.4.7 Chapter 91 and Coastal Zone

One of the layover facilities on the New Bedford Line, Wamsutta, would require construction in landlocked tidelands within the coastal zone (Table 2-25). On the Fall River line, the ISP site would not require work in the coastal zone or in any area subject to Chapter 91. Both the Weaver's Cove East and West sites would likely require Chapter 91 licenses due to construction in filled tidelands.

Neither of the proposed layover sites on the New Bedford Main Line is within a Designated Port Area (DPA). The Weaver's Cove West site is within a DPA, and may be inconsistent with the designated uses of this marine area.

Table 2-25 Project Elements in Filled Tidelands – Layover Sites

Facility Name	Waterbody	Municipality	Jurisdictional
Church Street	none	New Bedford	none
Wamsutta	New Bedford Harbor	New Bedford	Landlocked Tidelands Coastal Zone
ISP	None	Fall River/ Freetown	none
Weaver's Cove East	Taunton River	Fall River	Filled Tidelands Coastal Zone
Weaver's Cove West	Taunton River	Fall River	Filled Tidelands Coastal Zone

2.4.8 Hazardous Materials

On the New Bedford line, there are Recognized Environmental Conditions (RECs) at both the Church Street and Wamsutta layover facility sites (Table 2-26). At the Wamsutta site, the RECs are associated with the capped Superfund site, and construction is not anticipated to encounter any contaminated soil or groundwater. At the Church Street site, the presence of high, medium and low RECs would require additional pre-construction investigations to determine the extent of soil or groundwater contamination and the cost of site remediation or disposal. The overall risk is considered "medium".

On the Fall River line, high to medium RECs are present at all three sites, as a result of prior industrial activities. Additional pre-construction investigations would be required to determine the extent of soil or groundwater contamination and the cost of site remediation or disposal. The risk to the project of encountering substantial amounts of contamination, and associated cleanup costs, are considered "high" at the ISP and Weaver's Cove West sites, and "medium to high" at the Weaver's Cove East site.

Table 2-26 Summary of RECs at the Proposed Overnight Layover Sites

Layover Facility	REC Description	Release Tracking Number (RTN)	Relative Impact
Church Street	Current Existence of 3,000 Gallon Diesel Aboveground Storage tank with Stained Soil on Site	Not applicable	High
	Presence of Pooled Oil and Stained Soil in Unpaved Area Near Site	Not applicable	Medium
	Historic and Current Use of Area Near Site for Vehicle Repair and Maintenance	Not applicable	Medium
	Existence of Underground Storage Tanks Near Site	Not applicable	Low
Wamsutta	Historic Use of Site as Freight Yard and Placement of Permanent Engineered Barrier Above Impacted Soil at Site	4-118	Medium
	Documented Release at Acushnet Estuary (New Bedford Superfund Site)	4-122	Medium
	Documented Release at Adjoining Property (618 Acushnet Avenue)	4-14791	Low
	Documented Release and Implementation of Activity and Use Limitation at Nearby Property (1 Wamsutta Street)	4-11715	Low
	Documented Release at Nearby Property (New Bedford Main Interceptor)	4-127	Low
ISP	Documented Releases on or Encompassing the Layover Site	4-13482, 4-13856, and 4-15907	High
	Existence of Large Quantity of Hazardous Chemicals and Existence of Risk Management Plan at Southwestern Adjoining Property (ISP Chemicals, 238 South Main Street)	Not applicable	High
	Historic Use of Adjoining Properties	Not applicable	High
	Documented Releases at Nearby Property (Former Synthetic Natural Gas Plant)	4-16971	Medium
	Documented Releases at Southwestern Adjoining Property (238 South Main Street)	4-10219, 4-10965, 4-11891, 4-13804, 4-13805, 4-18988, 4-14027, 4-14485, 4-15568, 4-15700, 4-16479, 4-16533, 4-16702, 4-16703, 4-19297, and 4-19557	Medium
Weaver's Cove East	Previous Use of Site as Oil Storage Facility and Documented Petroleum Release on Site	4-749	High
	Previous Use of Adjoining Property as Petroleum Product Distribution Facility and Documented Release (Shell Oil Company, 1 New Street)	4-749	High
	Previous Use of Building on Parcel T-1-38 as Commercial Garage	Not applicable	Medium
	Existence of Underground Storage Tanks (USTs) on Parcel T-1-38	Not applicable	Medium
	Possible Presence of Elevated Concentrations of Metals in Site Soil	Not applicable	Low
Weaver's Cove West	Existence of USTs and ASTs at Site	Not applicable	High
	Previous Use of Site as Petroleum Products Distribution Facility and Documented Release	4-749	High
	Possible Presence of Elevated Concentrations of Metals in Site Soil	Not applicable	Low

2.4.9 Cultural Resources

As shown in Table 2-27, neither layover facility on the New Bedford line would have adverse effects to any historic resources. On the Fall River line, the ISP site and Weaver's Cove West sites would not have adverse effects to any historic resources. The Weaver's Cove East site could have adverse effects to the visual setting of the North Main Street district.

Table 2-27 Potential Effects on Historic Resources

Location	Direct Effects	Indirect Effects
Church Street	None	No adjacent resources
Wamsutta	None	No adverse noise or visual impacts to adjacent historic industrial buildings
ISP Site	None	No adjacent resources
Weaver's Cove East	None	Potential adverse effects to the visual setting of the North Main Street district
Weaver's Cove West	None	No adjacent resources

As shown in Table 2-28, on the New Bedford line, the Church Street site was determined to have moderate sensitivity for archaeological resources, and would require additional investigation to determine if archaeological resources were present, and the significance of those resources. The Wamsutta Street site would not affect archaeological resources located below the capped landfill.

On the Fall River line, the ISP site is in an area identified as having a high sensitivity for pre-contact Native American sites, and is close to several documented significant archaeological sites (Mother Brook, Peace Haven). The Weaver's Cove East site has low sensitivity but requires additional investigation. The Weaver's Cove West site has been investigated and found to have no archaeological resources.

Table 2-28 Potential Effects on Archaeological Resources

Location	Archaeological Sensitivity	Recommendation
Wamsutta	High sensitivity for pre-contact/contact Native American sites and post-contact Euro-American resources	Avoid work below clean fill-geotextile composition cap, or conduct an intensive (locational) survey
Church Street	Moderate sensitivity for pre-contact/contact Native American sites and post-contact Euro-American resources	Avoid, or conduct an intensive (locational) survey
ISP	High sensitivity for pre-contact/contact Native American sites related to the Mother's Brook Site (19-BR-106)	Avoid, or conduct an intensive (locational) survey
Weaver's Cove East	Low sensitivity	Archaeological reconnaissance survey
Weaver's Cove West	No/Low sensitivity (previously surveyed)	No further work

2.4.10 Operations

As shown in Table 2-29, the Church Street site in New Bedford is located 3.1 miles north, 2.8 miles further than the Wamsutta site. On the Fall River Secondary, the ISP Site is located 5.3 miles from the terminal station, 2.7 miles further than the Weaver's Cove East and Weaver's Cove West sites. Figures 2-6 and 2-7 show the layover facilities in relation to the terminal station for New Bedford and Fall River respectively. As previously mentioned, ideally the layover facility wouldbe located close to the end of the line. If the layover facility is near the terminal, trains do not have to travel far to get to the start of their morning trips or from the end of their evening trips. If the layover facility is distant from the terminal, trains need to make a long distance non-revenue (deadhead) movement before they start their morning trips or after they end their evening trips. While, all the sites are located relatively close to the end of the lines, the Wamsutta site is closer to the terminal in New Bedford and would provide more efficient operation than the Church Street site. Similarly, the Weaver's Cove sites are closer to the terminal in Fall River and would provide a more efficient operation than the ISP Site.

Table 2-29 Distance to Terminal Station

Location	Distance from Terminal Station
Church Street	3.1 miles north
Wamsutta	0.3 miles north
ISP Site	5.3 miles north
Weaver's Cove East	2.6 miles north
Weaver's Cove West	2.6 miles north

2.4.11 Operations Costs

As shown in Table 2-30, the distance of a layover facility to the terminal station contributes directly to the increase in operating and maintenance cost of the site alternative. On the New Bedford Mainline, Church Street would be more expensive to operate due to an additional 2.8 miles (5.6 miles roundtrip) that the trains would need to run deadhead miles. On the Fall River Secondary, the ISP Site would have additional 2.7 deadhead miles (5.4 miles roundtrip) than the Weaver's Cove sites.

Table 2-30 Operating and Maintenance Cost

Location	$ (2009 dollars)
Church Street	$567,600
Wamsutta	$55,000
ISP Site	$970,400
Weaver's Cove East	$476,000
Weaver's Cove West	$476,000

While each layover site will also have a capital cost investment, there is negligible differentiating factor in capital investment for each site and would not distinguish one site as favorable over another. Capital cost estimates were not used in this layover facility alternatives analysis.

3

Site Selection

3.1 Requirements of the Secretary's Certificate

The Secretary's Certificate on the DEIR stated that:

"The FEIR should expand on the analysis of the proposed layover facilities with detailed plans for the layover facilities and a comparative analysis of environmental impacts with a summary table showing land alteration, impervious area, wetland and water quality impacts, traffic impacts, air quality, noise and vibration, impacts to conservation lands/open space, and impacts to Environmental Justice populations. The alternatives analysis should include consideration of potential sites outside of Riverfront Area….. **The FEIR should include a rationale for selection of the preferred layover facilities and for elimination of others from further consideration.** The evaluation of impacts associated with layovers should include potential conflicts and synergies with existing and future land use on and in the vicinity of the sites."

This document provides the rational for selection of the preferred layover facilities on the New Bedford and Fall River branches, as required by the Certificate. Detailed plans of each site, and a detailed analysis of environmental impacts, will be provided in the FEIS/FEIR.

3.2 Layover Facility Site Selection Criteria

The area of the layover facility site must be large enough to accommodate the anticipated number of trains, service vehicles, and other support facilities. The site must be shaped appropriately to allow all tracks to be long enough to accommodate the full length of a train on each track. The shape of a layover site is typically rectangular therefore making rectangular parcels better suited for siting a layover facility

Based on the operating plan that has been developed for South Coast Rail, each branch will require four trains to support the peak period service. In addition, a fifth train on each branch will be required as spare equipment, which can be used in the event of a breakdown. The layover facility must accommodate the five trains anticipated. In addition, the facility should provide one track for future expansion of service and for maintenance equipment. Therefore, each layover site chosen for South Coast Rail must be able to accommodate six tracks.

The site would minimize environmental impacts and provide the most efficient operation by locating it as close as possible to the terminal station to ensure the least deadhead miles for non-revenue movements in and out of the layover facility. While there is no hard rule for the distance of a layover facility from the terminal, increasing distance between a layover facility and the terminal station would result in less reliable operations and greater operating costs.

3.3 New Bedford Line

Two sites were evaluated on the New Bedford line: Church Street and Wamsutta. The tables and text below summarize the comparison of these sites based on environmental (Table 3-1) and practicability (Table 3-2) factors. The Wamsutta site was selected because it is most favorable from an environmental perspective: it requires the lesser land acquisition, the lesser tax revenue loss, the lesser wetland impacts, no potential risk of hazardous materials remediation, and no impacts to historic or archaeological resources.

Table 3-1 Comparison of New Bedford Layover Facility Sites – Environmental Factors

Resource	Church Street	Wamsutta	More Favorable
Land Acquisition	39 acres	11 acres	Wamsutta
Tax Revenue Loss	$21,378/year	$0.00/ year	Wamsutta
Environmental Justice	No impacts	No impacts	Equal
Noise Impacts	No impacts	No impacts	Equal
Wetland Impacts	0.07 acres vegetated wetland	None	Wamsutta
Wild and Scenic Rivers	None	None	Equal
Threatened and Endangered Species	None	None	Equal
Coastal Zone	None	Chapter 91 license not required for work in landlocked tidelands. Not within the DPA	Equal
Hazardous Materials	Medium risk	Capped Superfund landfill – no impacts anticipated	Wamsutta
Cultural Resources	Intensive archaeological survey required in areas of moderate sensitivity. No above-ground impacts	No impacts to archaeological resources below capped landfill. No adverse effects to above-ground resources.	Wamsutta

The Wamsutta site was selected also because it is most favorable from an operating and cost perspective: it is closer to the terminal station and would therefore require less operating dollars to pull the trains in and out of the layover facility at the end and beginning of the day.

Table 3-2 Comparison of New Bedford Layover Facility Sites – Cost and Operations

Operational Element	Church Street	Wamsutta	More Favorable
Distance to Terminal Station	3.1 miles	0.3 miles	Wamsutta
Operating Cost	$567,600	$55,000	Wamsutta

3.4 Fall River Line

Three potential layover sites were evaluated on the Fall River line. Table 3-3 compares the environmental effects of the ISP, Weaver's Cove East and Weaver's Cove West sites, and Table 3.4 compares the practicability of these site alternatives.

The ISP site was rejected because it would require a substantial amount of construction within a previously-undisturbed Riverfront Area, and because it would introduce new industrial visual elements along the Taunton Wild and Scenic River. The adjacent property, ISP Chemical is a chemical manufacturing plant which requires a high level of security, and which poses a risk in the event of a chemical accident. The operator of the facility has indicated that this land use is not compatible with an adjacent area where people may gather, or which has unrestricted access. In addition, this site has the potential to contain significant Native American archaeological resources.

The Weavers Cove West site was rejected because development of this site as a layover facility would require a large amount of land acquisition (58 acres) and loss of property tax revenues to the City of Fall River. The site is within the Designated Port Area, and would be inconsistent with the maritime uses of the site. Although it would be within Riverfront Area and adjacent to the Wild and Scenic Taunton River, it would result in redevelopment of this disturbed area and would not introduce a new visual element. The Weaver's Cove East site is the most favorable from an environmental perspective.

Table 3-3 Comparison of Fall River Layover Facility Sites – Environmental Factors

Resource	ISP	Weaver's Cove East	Weaver's Cove West	Most Favorable
Land Acquisition	44 acres	18 acres	58 acres	Weaver's Cove East
Tax Revenue Loss	$29,956/year	$57,317/year	$236,120/year	ISP
Environmental Justice	No impacts	No impacts	No impacts	Equal
Noise Impacts	No impact	1 moderate	1 moderate	ISP
Wetland Impacts	2.28 acres of Riverfront Area Work in Land Subject to Coastal Storm Flowage	None	Riverfront Area impacts Work in Land Subject to Coastal Storm Flowage	Weaver's Cove East
Wild and Scenic Rivers	Adjacent to Taunton Wild and Scenic River	Adjacent to Taunton Wild and Scenic River	Adjacent to Taunton Wild and Scenic River	Weaver's Cove East
Threatened and Endangered Species	None	None	None	Equal
Coastal Zone	Not within Coastal Zone	Potentially within Filled tidelands	Potentially within Filled Tidelands.	ISP
Hazardous Materials	High risk	Medium to high risk	High risk	Weaver's Cove East
Cultural Resources	High sensitivity for pre-contact Native American sites related to the Mother's Brook Site	No archaeological sensitivity. Potential adverse effects to visual setting of the North Main Street District.	No archaeological sensitivity. No effects on above-ground resources.	Weaver's Cove West

From an operational perspective, the Weavers Cove sites are more favorable to the ISP Site. They are close to the terminal station and would therefore require less operating dollars to pull the trains in and out of the layover facility at the end and beginning of the day.

Table 3-4 Comparison of Fall River Layover Facility Sites – Cost and Operational Factors

Operational Element	ISP	Weaver's Cove East	Weaver's Cove West	Most Favorable
Distance to Terminal Station	5.3 miles	2.6 miles	2.6 miles	Weaver's Cove East/West
Operating Cost	$970,400	$476,000	$476,000	Weaver's Cove East/West

3.5 Recommendations

As previously outlined, the area of the layover facility site must be large enough to accommodate the anticipated number of trains, service vehicles, and other support facilities. Based on the operating plan that has been developed for South Coast Rail, each branch will require four trains to support the peak period service, a fifth train on each branch to provide a spare, and finally a sixth to accommodate future expansion Therefore, each layover site chosen for South Coast Rail must be able to accommodate six tracks.

The site selection would look to minimize environmental impacts and provide the most efficient operation that minimizes deadhead/non-revenue miles by locating the layover as close as possible to the terminal station. While there is no hard rule for the distance of a layover facility from the terminal, increasing distance between a layover facility and the terminal station would result in less reliable operations and greater operating costs

On the Fall River Secondary, ***Weaver's Cove East is the favorable location to site a Fall River layover facility*** as it has the least environmental impacts of the Fall River sites with fewest land acquisition, wetland impacts, impact to wild and scenic rivers, and from the perspective of encountering hazardous materials. Weaver's Cove East would also be operationally more efficient than ISP with its close proximity to the terminal station saving the project roughly $500,000 annually.

On the New Bedford Mainline, ***Wamsutta is the favorable location to site a New Bedford layover facility*** as it has less environmental impact than the Church Street site from the perspective of land acquisition, tax revenue loss, wetlands, hazardous materials, and cultural resources. Wamsutta would also be operationally more efficient saving the project roughly $500,000 annually.

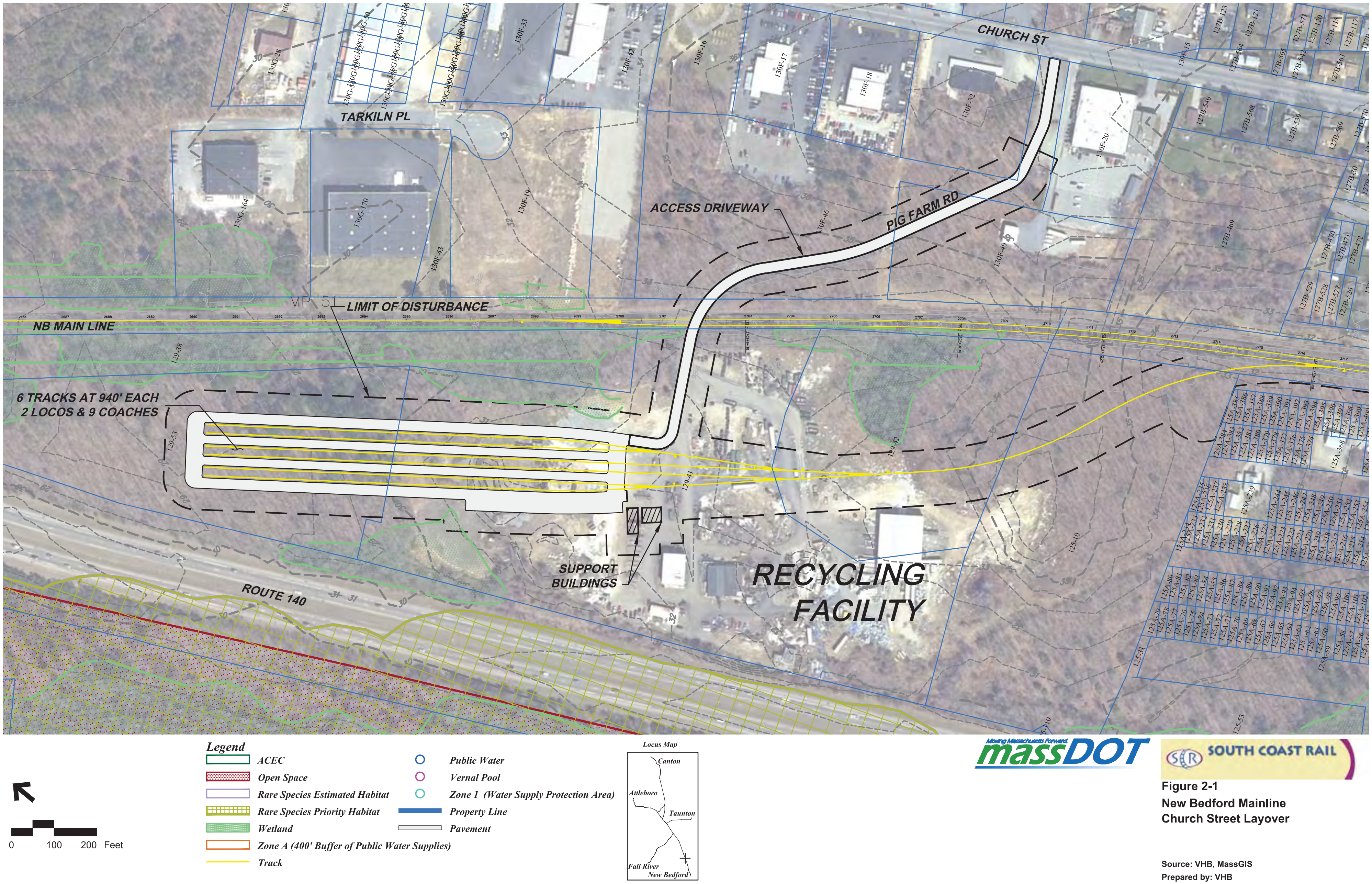


Figure 2-1
New Bedford Mainline
Church Street Layover

Source: VHB, MassGIS
Prepared by: VHB

\\mabosdata\projects\10111.00\cad\te\planmisc\TrackAlignments\LayoverYards\10111PR-rail-14study.dwg Printing Date: 11/21/2011 1:14 PM

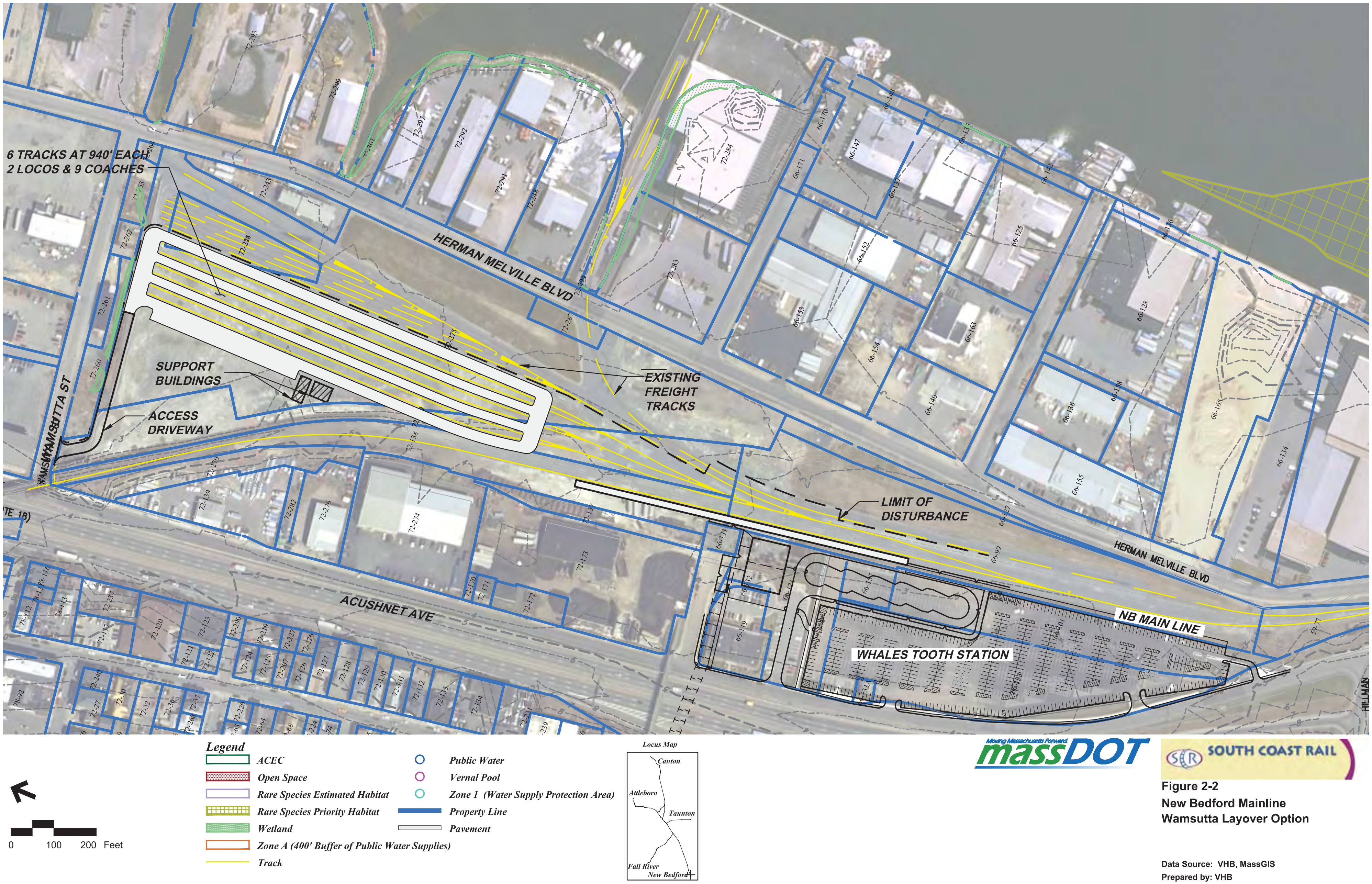
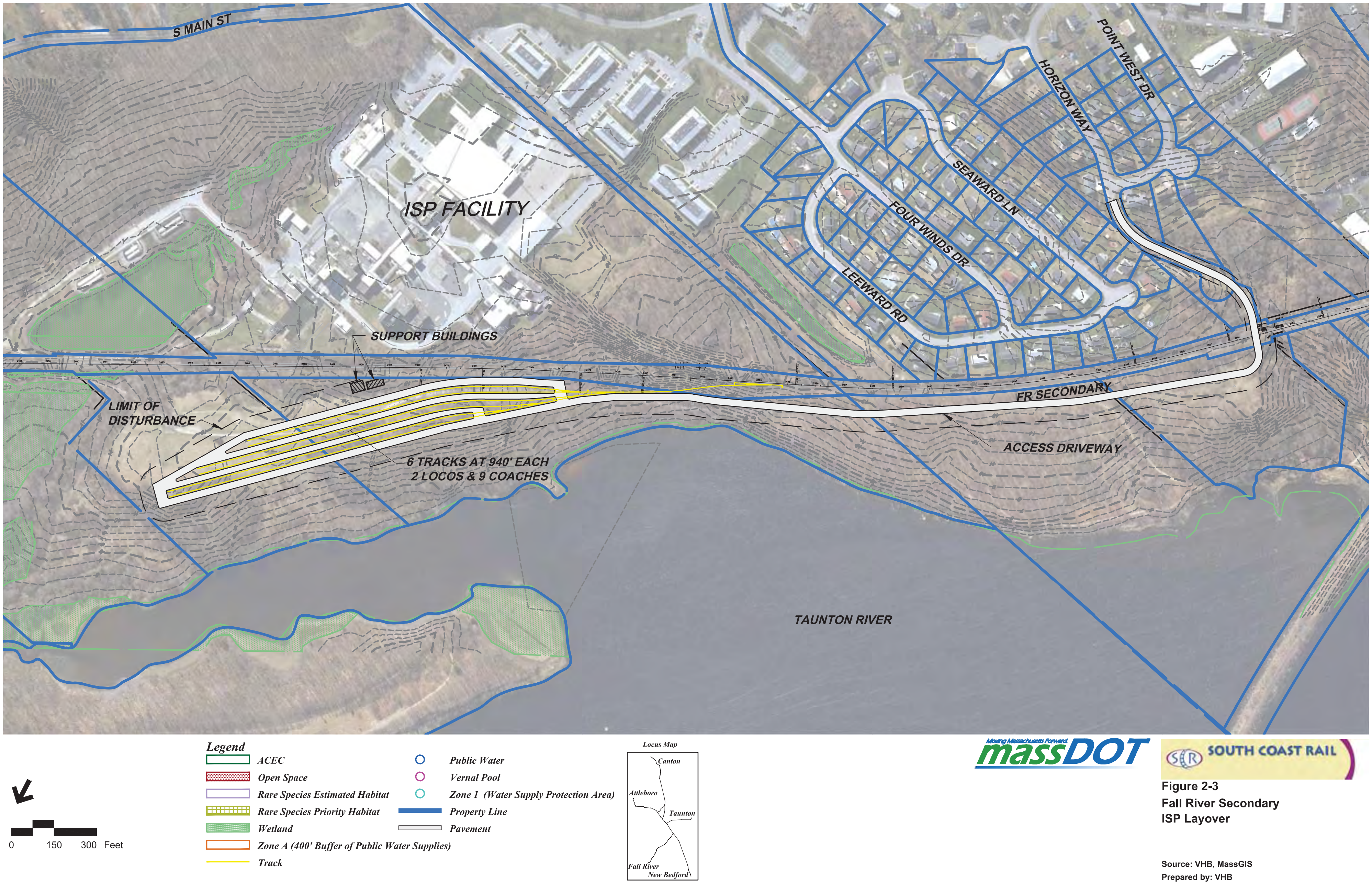


Figure 2-2
New Bedford Mainline
Wamsutta Layover Option

Data Source: VHB, MassGIS
Prepared by: VHB

\\mabosdata\projects\10111.00\cad\te\planmisc\TrackAlignments\LayoverYards\10111PR-rail-10study-wWhalesTooth.dwg Printing Date: 11/21/2011 8:26 AM



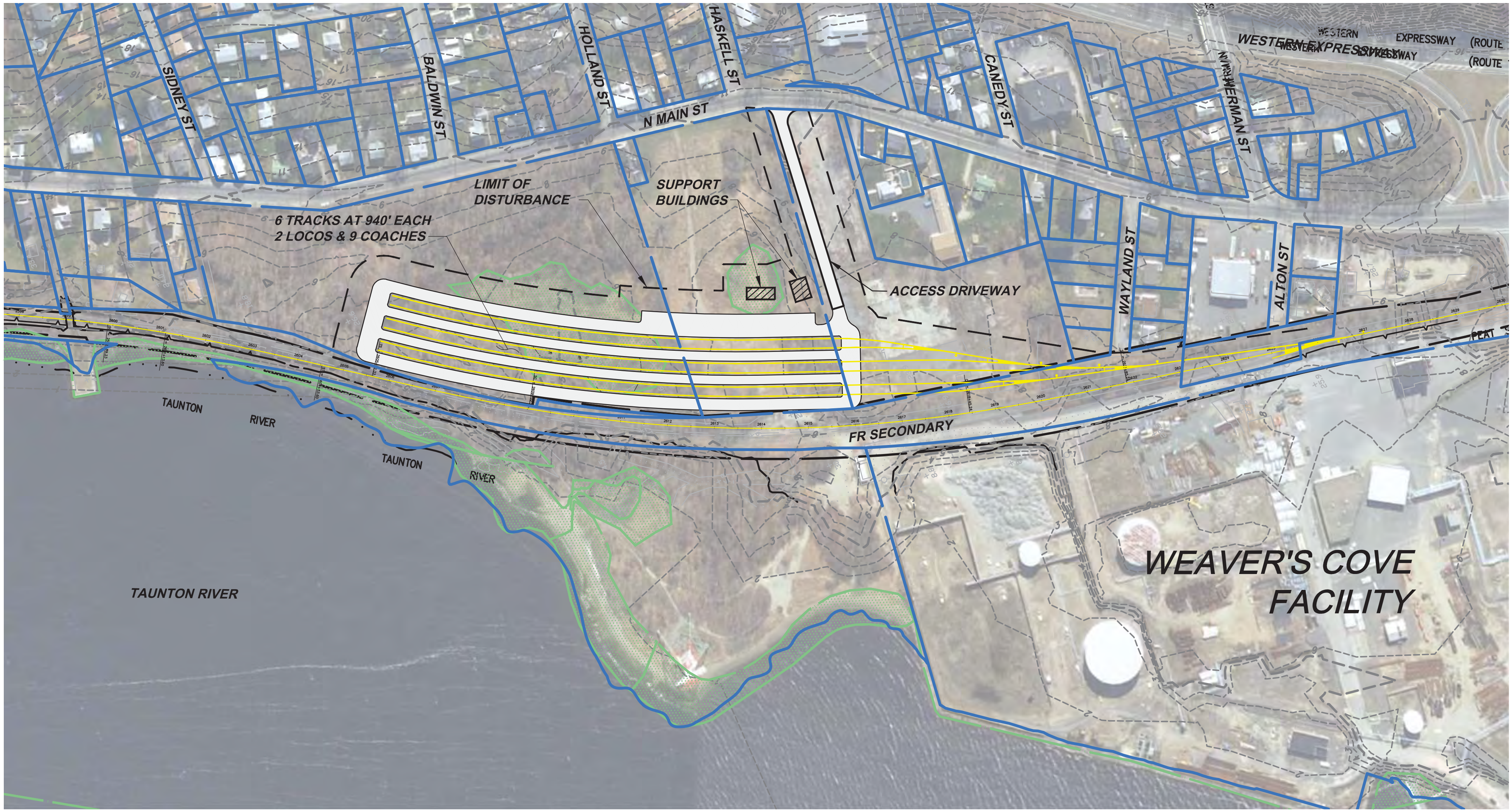
Moving Massachusetts Forward. massDOT

SOUTH COAST RAIL

Figure 2-3
Fall River Secondary
ISP Layover

Source: VHB, MassGIS
Prepared by: VHB

\\mabosdata\projects\10111.00\cad\te\planmisc\TrackAlignments\LayoverYards\10111PR-rail-5study.dwg Printing Date: 11/21/2011 1:20 PM



Legend

- ACEC
- Open Space
- Rare Species Estimated Habitat
- Rare Species Priority Habitat
- Wetland
- Zone A (400' Buffer of Public Water Supplies)
- Track
- Public Water
- Vernal Pool
- Zone 1 (Water Supply Protection Area)
- Property Line
- Pavement

0 100 200 Feet

Locus Map

Canton
Attleboro
Taunton
Fall River
New Bedford

massDOT Moving Massachusetts Forward.

SOUTH COAST RAIL

Figure 2-4
Fall River Secondary
Weaver's Cove East Layover

Source: VHB,MassGIS
Prepared by: VHB

\\mabosdata\projects\10111.00\cad\te\planmisc\TrackAlignments\LayoverYards\10111PR-rail-3Astudy.dwg Printing Date: 11/21/2011 11:37 AM

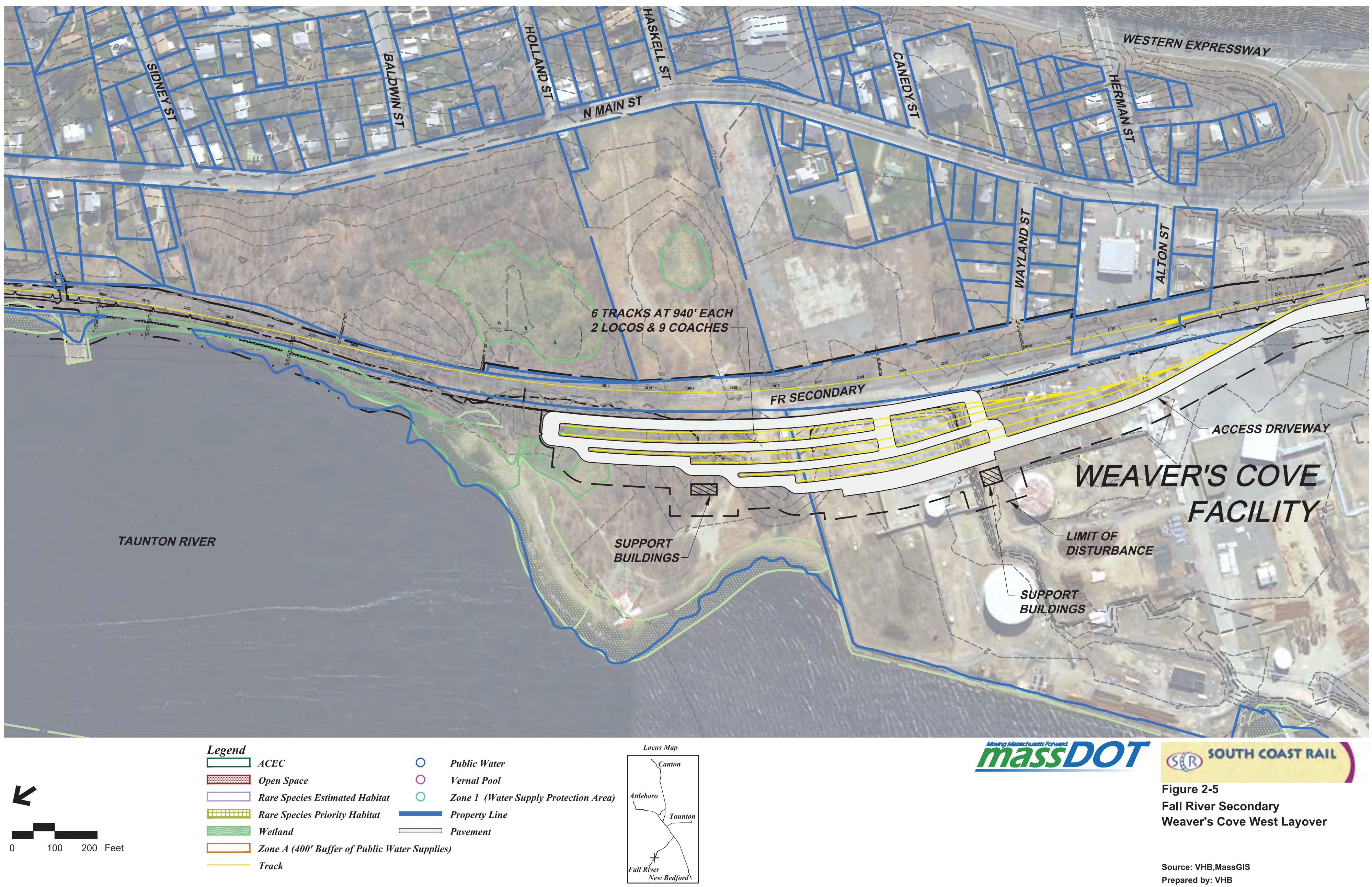


Figure 2-5
Fall River Secondary
Weaver's Cove West Layover

Source: VHB,MassGIS
Prepared by: VHB

\\mabosdata\projects\10111.00\cad\te\planmisc\TrackAlignments\LayoverYards\10111PR-rail-3studyweavercovewest.dwg Printing Date: 12/28/2011 3:20 PM

\\mabosdata\projects\10111.00\tech\FINAL_EIS_EIR\Layovers\Figures\1011100-NewBedford-Layovers.dwg Printing Date: 12/22/2011 4:55 PM

Moving Massachusetts Forward. massDOT

SOUTH COAST RAIL

0 1500 3000 Feet

Figure 2-6
New Bedford Main Line

Layover Yard Options

Prepared by: VHB

\\mabosdata\projects\10111.00\tech\FINAL_EIS_EIR\Layovers\Figures\1011100-FallRiver-Layovers.dwg Printing Date: 12/22/2011 3:14 PM

SOUTH COAST RAIL

Figure 2-7
Fall River Secondary Layover Yard Options

Prepared by: VHB

Appendix 3.2-F

Construction Staging Memorandum

FEIS/FEIR Technical Report

Construction Staging Memo

Prepared for

massDOT

Massachusetts Department of Transportation
10 Park Plaza
Boston, Massachusetts 02116-3969

Prepared by

VHB *Vanasse Hangen Brustlin, Inc.*
99 High Street, 10th Floor
Boston, Massachusetts 02110-2354

SCR
SOUTH COAST RAIL

June 2012

Table of Contents

List of Tables

List of Figures

This page intentionally left blank.

1

Construction Staging Summary

1.1 General

The purpose of this Construction Staging summary is to identify feasible construction staging and sequencing options for the construction of various elements of the South Coast Rail (SCR) project. An assessment of potential construction access locations and laydown areas for bridge construction and site specific constraints are contained in Part 2 - Bridge Access & Laydown Summary.

All construction will be performed in close coordination with the operating railroads - Massachusetts Bay Transportation Authority (MBTA), Mass Coastal Railroad (MCRR), and CSX. Flagging and inspection services will be provided by the operating railroad for a given section of track as defined under Railroad Operations and Coordination. The work will include the construction of retaining walls, bridges, stations, station platforms, track, special track work, interlockings, drainage, culvert rehabilitations, maintenance of utilities, power substations, and overhead catenary.

Proposed track within the active right-of-way will be reconstructed between 7:00 PM and 7:00 AM weeknights and over extended weekends subject to MCRR delivery consolidation, except in specified areas in the vicinity of the Acushnet Cedar Swamp, during amphibian breeding season (mid-March through Mid-April) as noted in the Biodiversity Report.

1.1.1 General Sequence of Work

The following provides a general construction sequence of construction for the South Coast Rail Project.

- Clear and grub, demolish buildings and address HAZMAT issues on all property taken for the project.
- Construct station and substation site features beyond the right-of-way.
- Remove abandoned tracks and utilities along the right-of-way.
- Construct retaining walls, culverts and bridges.
- Install drainage and utility improvements.

- Grade right of way and prepare subgrade for track construction.
- Install track and relocate existing track to remain.
- Construct platforms and canopies.
- Install signal cable, conduit, foundations and signal equipment.
- Install catenary foundations, poles, cantilevers, brackets and wires.

1.1.2 Railroad Operations and Coordination

MassCoastal Railroad (MCRR) operates and maintains freight service south of Winter Street in Taunton to New Bedford and Fall River. CSX Customer freight service operates between Weir Junction and Cotley Junction where deliveries are made during the week between 7:00 AM and 7:00 PM. There are no deliveries scheduled on weekends unless a special delivery is needed or a weekday delivery is postponed to a Saturday. Daily MCRR freight service passes through Cotley Junction to destinations in New Bedford and Fall River on alternate days. During SCR construction, deliveries can be coordinated through MCRR and CSX with customers to reduce the number of weekly shipments and provide longer windows for track and bridge construction. Depending on the customer and the location of the construction, shipments can be consolidated to allow for up to a 6-day (including the weekend) track outage once a month.

Passenger service at existing Canton and Stoughton stations cannot be disrupted on weekdays, during peak hours. Work in those areas will be scheduled during off-peak hours - midday, at night, or on weekends. Service shutdowns and flagging will have to be coordinated through MBTA.

All work outside of the active right-of-way can be completed during regular working hours as long as the work does not foul or have the potential to foul active tracks. This work may include station and substation sites and any work within the inactive right-of-way. Work that has the potential to foul active track will be limited to off-peak hours, nights and weekends or during service shutdowns, will require a flagger present and must be approved by the operating railroad(s) MBTA, MCRR and/or CSX. Work within the active commuter rail right-of-way will be subject to MBTA approval and will require an MBCR flagman to be present.

1.1.3 Bridge Construction Sequencing

Bridge reconstruction along active rail lines will be staged depending on the number of existing and proposed tracks. Bridge staging will take precedence over track staging with consideration for nearby structures, right-of-way limits and wetland boundaries. The work will be sequenced in order to minimize impacts to local rail and roadway traffic. A Bridge Staging Summary Table is provided on pages 3 and 5.

Table 1-1 Construction Staging Summary

General								Bridge		Tracks				CONSTRUCTION								
															Type		Grade Crossings Within 1500 Feet		Access			
Line	Operating Railroad	Approx. MP[2]	SCR MP[3]	Stationing	DOT No	Description	Town	Undergrade/ Overhead	Proposed Type	Active	Existing Service[4]	Proposed Offset	Signals Territory	Method*	Existing Tracks	Proposed Tracks	North	South	North	South	Approx. Duration	Comments
STOUGHTON LINE																						
S	MBTA	0.87	15.79	833+71.2	—	Kingsly Pond (Forge Pond)	Canton	UG	Precast Girder Ballasted Deck	Active	P	14	Signalized	B	1	2	Washington Street	—	—	Washington Street, Ames Ave	1yr	
S	MBTA	1.19	16.11	850+60.8	546730J	Bolivar Street	Canton	UG	Steel Beam Tub Ballasted Deck	Active	P	14	Signalized	B	1	2	—	—	Bolivar Street	Bolivar Street	4mo	Should be sequenced with Bolivar and Mill Brook if required for access
S	MBTA	1.64	16.56	874+36.8	—	Mill Brook	Canton	UG	Precast Girder Ballasted Deck	Active	P	14	Signalized	B	1	2	—	Pine Street	—	Pine Street	1yr	Should be sequenced with Bolivar and Mill Brook if required for access
S	MBTA	4.22	19.07	1006+89.6	546738N	Coal Yard Road	Stoughton	UG	Precast Box Girder Ballasted Deck	Active	P	14	Signalized	D	2	2	Wyman Street, Porter Street	Brock Street	—	Washington Street	4mo	—
						End Active Track																
S	—	5.93	20.85	1100+88.0	546745Y	Totman Farm Road	Stoughton		Steel Beam Tub Ballasted Deck	—	—	16.6	Dark	B	1	2	—	—	Totman Farm Road	Washington Street	6mo	Tracks out of service
S	—	6.65	21.57	1139+00.0	—	Day's Farm Road (Private)	Easton	UG	Steel Beam Tub Ballasted Deck	—	—	20.6	Dark	B	1	2	—	—	Totman Farm Road	—	2mo	Tracks out of service. Construct Days Farm, Cowessett Brook and Totman Farm bridges in sequence
S	—	6.83	21.75	1148+28.0	—	Cowessett Brook	Easton	UG	Steel Beam Tub Ballasted Deck	—	—	0	Dark	B	1	1	—	—	Totman Farm Road	Elm Street	6mo	Tracks out of service. Construct Days Farm, Cowessett Brook and Totman Farm bridges in sequence
S	—	7.88	22.80	1204+00.0	—	Pond Street (Ped.)	Easton	UG	Steel Beam Tub Ballasted Deck	—	—	0	Dark	_	1	1	Elm Street, Oliver Street	—	Shovel Shop Square	Pond Street	2mo	Tracks out of service. Construct Days Farm, Cowessett Brook and Totman Farm bridges in sequence
S	—	7.92	22.84	1206+09.0	—	Small Creek	Easton	UG	Precast Box Girder Ballasted Deck	—	—	0	Dark	_	1	1	Oliver Street	—	Sullivan Street	—	2mo	Small Creek Bridge should be constructed after Pond Street Bridge if it is required to use the bridge over Pond Street for access
S	—	8.01	22.93	1211+23.2	546750V	Main Street	Easton	OH		—	—	0	Dark	_	1	1	Oliver Street	Williams Street	Main Street	—	2yr	Construction at Bridge Street should not occur at the same time
S	—	8.35	23.27	1228+65.6	546751C	Bridge Street	Easton	OH		—	—	0	Dark	_	1	1	Williams Street	—	Bridge Street	—	2yr	Construction at Main Street should not occur at the same time
S	—	11.25	26.17	1425+00.0	—	Hockomock Swamp Trestle	Raynham	UG		—	—	0	Dark	_	1	1	Foundry Street	—	Foundry Street	Race Track Crossing	2.5yr	Detailed in separate memo
S	—	15.28	30.20	1594+56.0	—	Bridge Street	Raynham	OH		—	—	14	Dark	_	1	2	—	Elm Street	Bridge Street	Elm Street	2yr	—
S	—	16.46	31.38	1656+86.4	—	Route 138 Grade Separation	Raynham	OH		—	—	0	Dark	_	1	1	—	Britton Street	Rte. 138	—	1.5yr	—
S	—	18.48	33.40	1763+52.0	—	Thrasher Street	Raynham	OH		—	—	14	Dark	_	1	2	—	—	Thrasher Street	Longmeadow Road	1.5yr	—
		18.93	33.81	1784+95.0		Begin Active Track																
S	CSX	19.50	34.38	1815+16.0		Taunton River	Taunton	UG	Through Plate Girder Open Deck	Active	F	0	Dark	A1	1	1	Dean Street	—	Deane Street	—	1yr	Should be sequenced with the other Taunton River and Mill River crossings. May require several lengthy work windows
S	CSX	19.70	34.62	1828+02.0	—	Taunton River	Taunton	UG	Through Plate Girder Open Deck	Active	F	0	Dark	A1	1	1	Dean Street	Summer Street	Deane Street	—	1yr	Should be sequenced with the other Taunton River and Mill River crossings. May require several lengthy work windows
S	CSX	19.80	34.73	1833+69.0	—	Taunton River	Taunton	UG	Through Plate Girder Open Deck	Active	F	0	Dark	A1	1	1	—	Summer Street, High Street	Dean Street	—	1yr	Should be sequenced with the other Taunton River and Mill River crossings. May require several lengthy work windows
S	CSX	20.00	34.90	1842+87.0	—	Mill River	Taunton	UG	Steel Beam Tub Ballasted Deck	Active	F	0	Dark	A1	1	1	Summer Street	High Street	Dean Street	—	6mo	Should be sequenced with the Taunton River crossings. May require several lengthy work windows

Notes:
1. Construction details assume one freight train per day between 7 AM and 7 PM
2. "Approx. MP" is based on point of beginning with Milepost 0.0 at Canton Junction for the Stoughton Line
3. "SCR MP" is based on point of beginning with Milepost 0.0 at South Station
4. P: Passenger; F: Freight

* Construction Method Legend
- A1: Roll in new structure during shutdown, 1 Existing Track, 1 Proposed Track
- A2: Oversized substructure, 1 Existing Track, 1 Proposed Track
- B: Construct ½ new bridge then replace existing, 1 Existing Track, 2 Proposed Tracks
- C: Construct ½ bridge at a time, 2 Existing Tracks, 2 Proposed Tracks

This page intentionally left blank.

Table 1-1 Construction Staging Summary (Continued)

															CONSTRUCTION							
General								Bridge		Tracks					Type		Grade Crossings Within 1500 Feet		Access			
Line	Operating Railroad	Approx. MP[2]	SCR MP[3]	Stationing	DOT No	Description	Town	Undergrade/ Overhead	Proposed Type	Active	Existing Service[4]	Proposed Offset	Signals Territory	Method[5]	Existing Tracks	Proposed Tracks	North	South	North	South	Approx. Duration	Comments
NEW BEDFORD LINE																						
NB	CSX	11.80	35.56	1877+55.0	—	Taunton River	Taunton	UG	Through Plate Girder Ballasted Deck	Active	F	14	Dark	B	1	2	Ingell Street	—	Ingell Street	—	2 yr	
NB	CSX	12.00	35.79	1889+50.0	537302N	Brickyard Road	Taunton	UG	Precast Box Girder Ballasted Deck	Active	F	14	Dark	B	1	2	—	Hart Street	—	Plain Street Akron Street	4 mo	
NB	MCRR	13.90	37.69	1989+82.0	537304C	Route 24	Taunton	OH		Active	F	14	Dark	B	1	2	—	West Stevens Street	Route 24	Route 24	2 yr	Needs to allow both tracks to be constructed below.
NB	MCRR	15.17	38.93	2055+67.0	—	Cotley River	Berkley	UG	Steel Beam Tub Ballasted Deck	Active	F	14	Dark	B	1	2	—	—	Cotley Street	Padelford Street	1 yr	
NB	MCRR	15.70	39.46	2083+69.0	—	Cotley River	Berkley	UG	Steel Beam Tub Ballasted Deck	Active	F	14	Dark	B	1	2	—	—	Cotley Street	Padelford Street	1 yr	
NB	MCRR	18.60	42.14	2225+16.0	—	Assonet River	Lakeville	UG	Steel Beam Tub Ballasted Deck	Active	F	7.4	Dark	A2	1	1	—	—	Malbone Street	Howland Road	9 mo	Widen the proposed structure to account for rail traffic throughout construction.
NB	MCRR	21.65	45.43	2398+96.0	—	Fall Brook	Freetown	UG	Steel Beam Tub Ballasted Deck	Active	F	9.7	Dark	A2	1	1	—	Chace Road	—	Chace Road	9 mo	This location is a priority for sequencing construction with other bridges on the line due to existing bridge condition.
NB	MCRR	30.38	54.17	2860+00.0	5373273	Route 18	New Bedford	UG	Through Plate Girder Ballasted Deck	Active	F	0	Dark	A2	1	1	—	—	Purchase Street	Purchase Street	1.5 yr	Track to be deactivated from this point to the terminus at the proposed New Bedford Station.
NB	MCRR	54.21	54.21	2862+50.0	537328R	Wamsutta Street	New Bedford	UG	Through Plate Girder Ballasted Deck	Active	F	0	Dark	A2	1	1	—	—	Rail Yard	Rail Yard	1.5 yr	Track to be deactivated from this point to the terminus at the proposed New Bedford Station.
FALL RIVER SECONDARY:																						
FR	MCRR	0.92	41.51	2192+00.0	—	Cedar Swamp River	Lakeville	UG	Through Plate Girder Ballasted Deck	Active	F	0	Dark	A1	1	1	—	—	Adams Lane	Beechwood Road	8 mo	The proposed bridge is to be constructed within track outage windows.
FR	MCRR	4.98	45.58	2407+00.0	537363E	Route 24/79	Freetown	UG		Active	F		Dark	—			—	—	—	—		Bridge construction not required.
FR	MCRR	5.93	46.53	2457+35.0	537366A	Farm Road	Freetown	UG	Steel Beam Tub Ballasted Deck	Active	F		Dark	A2	1	1	—	—	South Main Street	Farm Road	1 yr	Widening the proposed structure to account for rail traffic will require work around the active track.
FR	MCRR	6.77	47.75	2501+00.0	537368N	Farm Road	Fall River	UG	(Remove & Fill in)	Active	F	0	Dark	—	1	1	—	—	—	Golf Cart Road	2 mo	Filling operations would require the work to be completed under track outage windows.
FR	MCRR	6.92	47.90	2529+61.2	—	Golf Cart Road	Fall River	OH	Concrete Deck on Steel Stringer	Active	F	15	Dark	—	1	1	—	—	—	Golf Club Road	1 yr	Needs to be constructed to allow track construction below.
FR	MCRR	7.13	48.11	2540+70.0	537369V	Golf Club Road	Fall River	OH	Concrete Deck on Steel Stringer	Active	F	15.5	Dark	—	1	2	—	—	—	Golf Club Road	1 yr	Needs to be constructed to allow track construction below.
FR	MCRR	7.98	48.62	2567+50.0	537370P	Miller's Cover Road	Fall River	UG	Steel Beam Tub Ballasted Deck	Active	F	0	Dark	A2	1	1	—	—	Miller's Cove Road		1 yr	Widening the proposed structure to account for rail traffic will require work around the active track
FR	MCRR	8.42	49.06	2590+70.0	537372D	Collins Street	Fall River	UG	Steel Beam Tub Ballasted Deck	Active	F	0	Dark	A2	1	1	—	—	Collins Road	North Main Street	1 yr	
FR	MCRR	8.58	49.21	2599+00.0	546592X	Ashley's Underpass	Fall River	UG	Steel Beam Tub Ballasted Deck	Active	F	2	Dark	A2	1	1	—	—	Collins Road	Canady's Underpass	1 yr	Widening the proposed structure to account for rail traffic will require work around the active track.
FR	MCRR	10.40	51.03	2695.00.0	546594L	Brownell Street	Fall River	UG	Steel Beam Tub Ballasted Deck	Active	F	0	Dark	B	1	1	—	—	Brownell Street	Pearce Street	1 yr	
FR	MCRR	10.48	51.11	2699+00.0	546595T	President's Avenue	Fall River	UG	Through Plate Girder Ballasted Deck	Active	F	0	Dark	B	1	1	—	—	President's Avenue	Parking Lot off North Main Street	1 yr	
FR	MCRR	10.57	51.20	2704+00.0	546596A	Pearce Street	Fall River	UG	Steel Beam Tub Ballasted Deck	Active	F	14	Dark	C	1	1	—	—	Pearce Street	Main Street		Bridge construction not required.
FR	MCRR	10.77	51.40	2714+50.0	546597G	Turner Street	Fall River	UG	Steel Beam Tub Ballasted Deck	Active	F	14	Dark	C	1	2	—	—	Turner Street	Open lay-down area		Bridge construction not required.
FR	MCRR	11.50	52.09	2751+00.0	—	Quequechan River	Fall River	UG	Steel Beam Tub Ballasted Deck	Active	F	0	Dark	—	1	1	—	—	Rail Yarde	—	6 mo	Construction cannot be phased at this location, so the track will be shut down and service suspended during bridge construction.

Notes:
1. Construction details assume one freight train per day between 7 AM and 7 PM
2. "Approx. MP" is based on point of beginning with Milepost 0.0 at Canton Junction for the Stoughton Line
3. "SCR MP" is based on point of beginning with Milepost 0.0 at South Station
4. P: Passenger; F: Freight

* Construction Method Legend
A1: Roll in new structure during shutdown, 1 Existing Track, 1 Proposed Track
A2: Oversized substructure, 1 Existing Track, 1 Proposed Track
B: Construct ½ new bridge then replace existing, 1 Existing Track, 2 Proposed Tracks
C: Construct ½ bridge at a time, 2 Existing Tracks, 2 Proposed Tracks

This page intentionally left blank.

One Existing Track - Two Proposed Tracks

The typical construction sequence to expand a single track bridge into a double track bridge will be as follows assuming the existing track is Track 1 and the proposed track is Track 2 (see figure on page 6).

- Demolish portions of the existing structure, as necessary, to construct the new Track 2 structure, while maintaining rail service on Track 1.
- Construct Track 2 structure and track.
- Install temporary crossovers no closer than 500 feet from the abutments and divert all railroad traffic to Track 2.
- Demolish remaining portions of existing Track 1 structure.
- Construct new Track 1 structure and track.
- Remove temporary crossovers after both track connections have been completed in their final configuration.

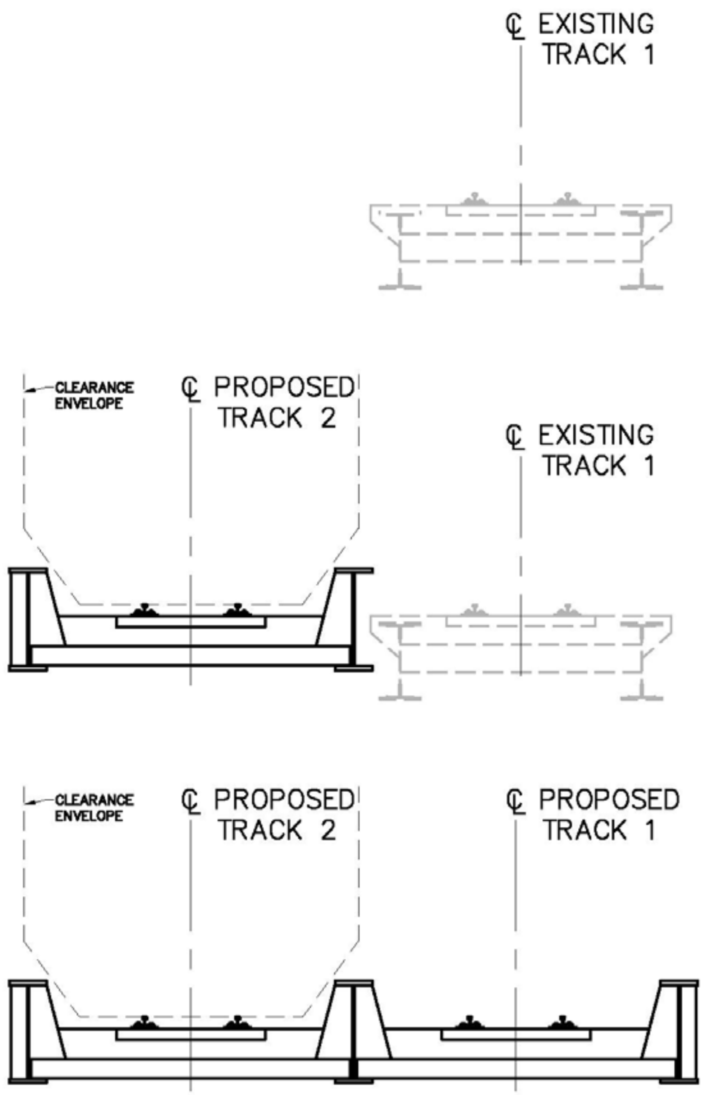
Two Existing Tracks - Two Proposed Tracks

Existing two-track bridges that will be reconstructed to accommodate two proposed tracks will utilize the following construction sequence (see figure on page 8).

- Install temporary crossovers, if necessary, to divert rail traffic to Track 2.
- Divert all railroad traffic to Track 2 over the existing bridge.
- Demolish the portions of the existing substructure that support Track 1.
- Construct proposed Track 1 substructure, superstructure and track.
- Divert rail traffic to the new Track 1 structure.
- Demolish remaining substructure and superstructure that supports Track 2.
- Construct proposed Track 2 structure and track
- Make track connections in their final configuration and remove temporary cross-overs.

One Existing Track - One Proposed Track

There are two options to reconstruct existing single track bridges. Both options must optimize material delivery and lay-down area access to minimize track outages. Option 1 will involve coordination with freight customers to consolidate deliveries during the week to provide longer track outage windows over the weekends. Option 2 will include the construction of wider abutments and a wider ballasted bridge structure to accommodate track shifts for maintenance of rail service. Option 1 is preferred and will be employed whenever possible. Option 2 may not feasible in areas with a constrained right-of-way



\\MABOSDATA\projects\10111.00\cad\st\planmisc\PhaseExample.dwg Printing Date: 4/23/2012 3:59 PM

Bridge Construction Sequence
One Existing Track -
Two Proposed Tracks

Not to Scale

Prepared by: VHB

Option 1

- Construct the substructure abutments and piers at night and on weekends while maintaining rail service weekdays between 7:00 AM and 7:00 PM.
- Consolidate freight shipments to reduce or eliminate weekly shipments, and allow extended weekday or weekend work windows.
- Assemble superstructure elements in a nearby laydown area.
- Over an extended weekend shut down rail service and remove the existing superstructure.
- Load superstructure elements onto flatbed rail cars.
- Roll in the preassembled superstructure over existing piers and place on temporary blocking.
- Remove upper portions of the existing piers and lower the superstructure onto the bridge seats and construct approaches.
- Construct track on approaches.
- Open bridge to rail service.
- Remove remaining portions of the existing piers and abutments

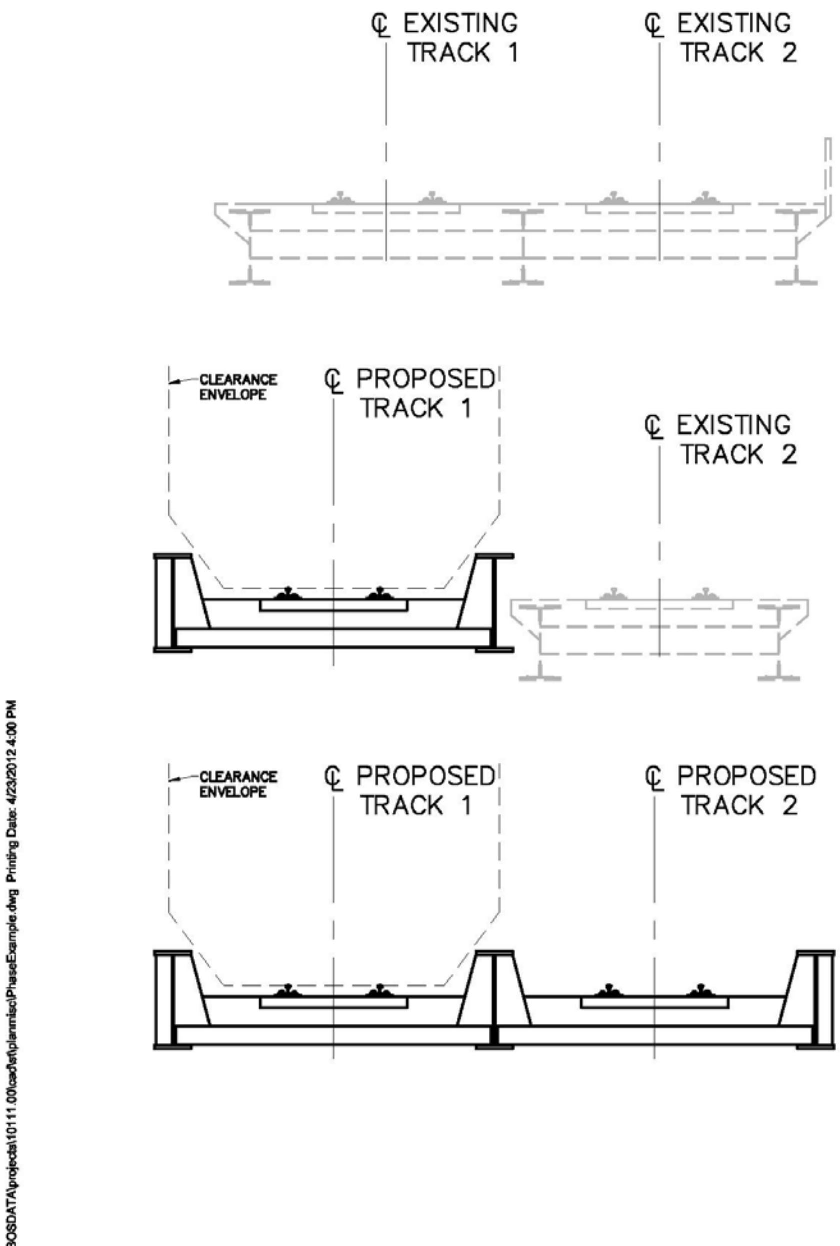
Under this scenario consecutive bridges will be constructed one location at a time to maximize access.

Option 2 (see figure on page 9)

- Construct the oversized abutments and piers at night and on weekends while maintaining rail service on the existing structure weekdays between 7:00 AM and 7:00 PM.
- Construct west half of the proposed superstructure.
- Install track on west half of the bridge and shift existing track on approaches to align with the track on the west half of the bridge.
- Remove existing superstructure and demolish substructure elements where possible.
- Construct east half of new superstructure while maintaining rail service on the west half of the bridge.
- Construct track in its final configuration.
- Remove remaining existing substructure elements.

Grade Crossings

Grade crossings located within 1500 feet of a bridge will have to be considered when evaluating the construction staging for the bridge. The Bridge Summary Table provided on pages 3 and 4 identifies the respective crossings for each bridge. In most cases reconstructing the crossing before the bridge may provide more operational flexibility. A new controller will improve the operation of the temporary and permanent crossings and the new equipment can be located to accommodate the various track shifts.

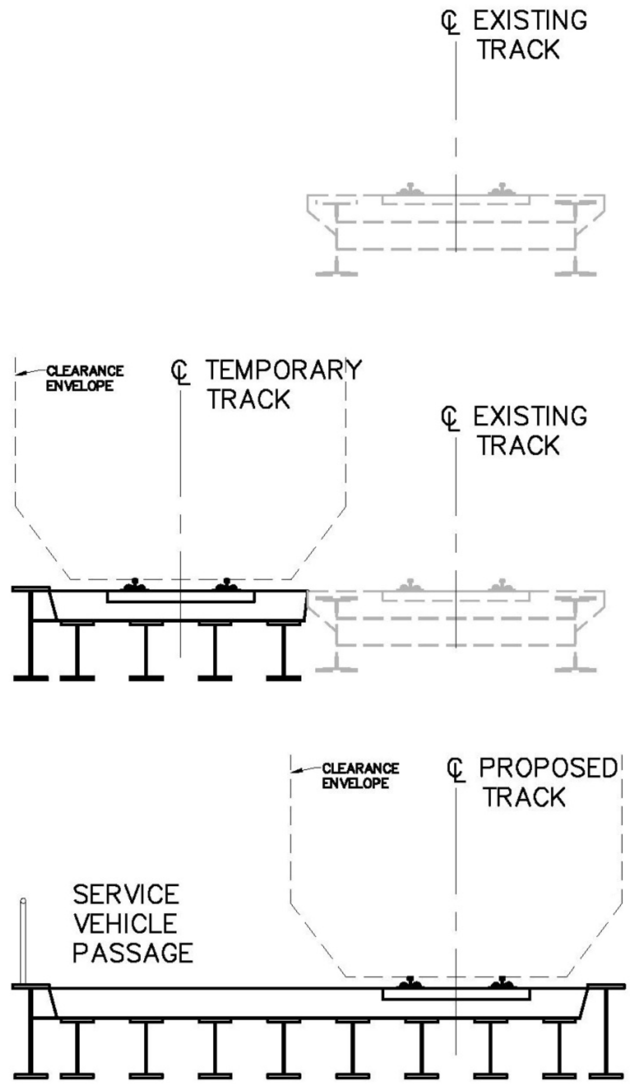


massDOT SOUTH COAST RAIL

Bridge Construction Sequence
Two Existing Tracks -
Two Proposed Tracks

Not to Scale

Prepared by: VHB



\\MABOSDATA\projects\10111.00\cad\st\planmisc\PhaseExample.dwg Printing Date: 4/23/2012 4:01 PM

massDOT SOUTH COAST RAIL

Bridge Construction Sequence
One Existing Track -
One Proposed Track
Option 2

Not to Scale

Prepared by: VHB

1.2 Stoughton Line

The SCR project will reconstruct the Stoughton Line from just south of Canton Junction Station to Weir Junction. This line has active passenger and freight service to Stoughton Station and active freight service between Winter Street in Taunton and Weir Junction. The right-of-way between Brock Street in Stoughton (MP 4.55) and Winter Street in Taunton (MP 18.93) is currently inactive with no rail remaining intact south of Short Street in Easton. Walls, bridges, and culverts within the inactive right-of-way can be constructed as resources allow. Construction within the active right-of-way must be coordinated and scheduled with MBTA and MCRR to minimize impacts to rail service and local traffic.

1.2.1 Retaining Walls

Construct retaining walls to the extent possible without fouling the active track. Work that requires foul time will be completed as allowed by flaggers. Retaining walls will be constructed along approximately 36,300 track feet as noted below.

- Station 818+00 to 821+00
- Station 833+00 to 836+00
- Station 839+00 to 851+00
- Station 856+00 to 871+00
- Station 879+00 to 885+00
- Station 894+00 to 899+00
- Station 981+00 to 996+00
- Station 1007+00 to 1009+00
- Station 1017+00 to 1033+00
- Station 1039+00 to 1062+00
- Station 1102+00 to 1116+00
- Station 1139+00 to 1145+00
- Station 1165+00 to 1171+00
- Station 1177+00 to 1232+00
- Station 1416+00 to 1425+00
- Station 1510+00 to 1543+00
- Station 1593+00 to 1602+00
- Station 1608+00 to 1611+00
- Station 1639+00 to 1683+00

- Station 1750+00 to 1762+00
- Station 1782+00 to 1797+00
- Station 1836+00 to 1839+00
- Station 1844+00 to 1854+00
- Station 1890+00 to 1902+00
- Station 1912+00 to 1941+00
- Station 1974+00 to 1977+00

1.2.2 Grade Crossings

Construct or remove the following grade crossings to the extent possible during the weekday hours within the inactive track areas and on nights and weekends with MBCR flagmen present within the active track areas. Active grade crossings that are proposed to be closed, such as Morton Street in Stoughton, cannot be dismantled/blocked until the proposed alternative access has been constructed.

- MP 0.70 Washington Street — Maintain
- MP 1.70 Pine Street — Maintain
- MP 2.10 Will Drive — Maintain
- MP 2.90 Central Street — Maintain
- MP 3.20 Simpson Street — Maintain
- MP 3.70 School Street — Maintain
- MP 3.90 Porter Street (RTE 27) — Maintain
- MP 4.00 Wyman Street — Maintain
- MP 4.30 Brock Street — Maintain
- MP 4.60 Plain Street — Maintain
- MP 5.20 Morton Street — Close
- MP 5.30 Pearson's Crossing — Close
- MP 5.39 Stanley Prod. Co. — Close
- MP 5.60 Fish and Game Club — Close
- MP 7.60 Elm Street — Maintain
- MP 7.80 Oliver Street — Maintain
- MP 8.30 Williams Street — N/A
- MP 8.65 Easton DPW — Close
- Residential Access — Close
- 3-Way Path Crossing — Close
- MP 9.15 Gary Lane — Maintain

➤	MP 9.55 Short Street	Maintain
➤	MP 10.00 Depot Street - Route 123	Maintain
➤	ATV Tracks (Multiple)	Close
➤	MP 10.20 Purchase Street	Maintain
➤	MP 10.90 Prospect Street	Maintain
➤	MP 11.40 Country Club	Close
➤	MP 11.80 Foundry Street - Route 106	Maintain
➤	MP 12.40 Power Line	Close
➤	MP 14.10 Race Track Crossing	Maintain
➤	MP 15.40 Elm Street	Maintain
➤	MP 15.80 Carver Street	Maintain
➤	MP 16.50 Britton Street	Maintain
➤	MP 17.10 King Phillip Street	Maintain
➤	MP 18.10 East Britannia Street	Maintain
➤	MP 18.90 Longmeadow Road	Maintain
➤	MP 19.40 Dean Street - Route 44	Maintain

1.2.3 Stations

The following stations will be constructed along the Stoughton Line as part of the SCR Project.

- Canton (reconstruct existing)
- Stoughton
- North Easton
- Easton Village
- Raynham Park
- Taunton

1.2.4 Bridges

Bridge reconstruction along the active right-of-way along the Stoughton Line will follow the bridge construction sequencing outlined on pages 2 through 9 as dictated by the number of existing and proposed tracks. Bridge staging will take precedence over track staging with consideration for nearby structures, property limits and wetland boundaries. The work will be sequenced in order to minimize impacts on the Stoughton central business district.

One Existing Track - Two Proposed Tracks

The following existing undergrade bridges along the Stoughton Line will be expanded to support a 2-track cross section.

- MP 0.87 (Station 836+45.60) Kingsley Pond (Forge Pond)
- MP 1.20 (Station 853+88.00) Bolivar Street
- MP 1.64 (Station 877+11.20) Mill Brook

Two Existing Tracks - Two Proposed Tracks

The two track bridge that carries the Stoughton line over Coal Yard Road (MP 4.22, Station 1013+33.60) will be reconstructed to accommodate two tracks.

One Existing Track - One Proposed Track

The following single track undergrade bridges along the Stoughton Line will be reconstructed to provide a new single track bridge.

- MP 19.50 (Station 1815+16.00) Taunton River
- MP 19.70 (Station 1828+02.00) Taunton River
- MP 19.80 (Station 1833+69.00) Taunton River
- MP 20.00 (Station 1842+87.00) Mill River

Inactive Right-of-Way

The following bridges to be reconstructed are located along the inactive portion of the Stoughton Line right-of-way and construction can proceed unimpeded. Refer to the Bridge Access Summary for additional notes on sequencing bridges with other locations.

- MP 5.90 (Station 1102+04.00) Totman Farm Road
- MP 6.60 (Station 1139+00.00) Day's Farm Road (Private)
- MP 6.80 (Station 1148+28.00) Cowessett Brook
- MP 7.90 (Station 1204+00.00) Pond Street (Ped.)
- MP 7.95 (Station 1206+09.00) Small Creek
- MP 8.05 (Station 1211+23.20) Main Street
- MP 11.11 (Station 1228+52.35) Bridge Street
- MP 14.01 (Station 1425+00 to Station 1510+00) Hockomock Swamp (See description below)
- MP 13.86 (Station 1517+78.00) Begin Siding L2
- MP 15.32 (Station 1595+08.80) Bridge Street
- MP 16.43 (Station 1653+69.60) Route 138 Grade Separation
- MP 18.33 (Station 1753+85.00) Begin Siding L3
- MP 18.45 (Station 1760+35.20) Thrasher Street

Hockomock Swamp Trestle

The trestle proposed to span the Hockomock Swamp as part of the SCR Project will minimize impacts to the vegetation and wildlife in the Hockomock Swamp. The trestle will consist of a multi-span, ballasted superstructure supported by deep foundations and will extend from station 1425+00 in Easton to station 1510+00 in Raynham.

Due to the sensitivity of the surrounding environment, the approved construction method will minimize impacts outside the existing railroad bed. The construction activities will be performed within the constraints of a set boundary on either side of the work area. The boundary will be defined by the installation of sedimentation and erosion controls along the existing railroad embankment.

The construction site can be accessed from the north by Foundry Street and from the south through Raynham Park. Raynham Park offers ample space for the primary laydown area. To the north, there may be limited space for laydown along the right-of-way, outside the limits of the swamp (adjacent to the Southeast Regional Vocational-Technical High School). During construction, the site would be accessed from the north and south ends, within the construction boundaries defined along the existing railroad right of way.

Before construction begins, existing power lines spanning the right-of-way will be raised as needed to meet minimum clearance requirements. The trestle will be constructed from both ends using at least two crews per operation. Precast concrete elements including pile caps, deck slabs, and box beams can be used to expedite construction and minimize disruption within the swamp. The construction sequence will include the following.

- Install erosion controls and perform selective clearing and trimming of vegetation.
- Construct infiltration trenches and perform earthwork between pier locations.
- Drive piles starting from the center of the trestle, working out toward Foundry Street and Raynham Park. Each crew will work from separate laydown areas at each end of the trestle. Install precast pile caps prior to driving the next set of piles so construction equipment can progress outward, on the embankment, within the construction boundaries to the next pier location.
- Install precast concrete box beams using two crews starting at each end, working toward the center of the trestle. The transverse post-tensioning of the box beams must be completed during the installation of each span to allow construction access over the trestle to install the beams for next span.
- Install precast concrete deck panels. Deck panels may be installed span by span with the box beams or after all of the beams are in place.
- Install deck drainage, ballast, track, signal cables, traction power and ancillary items.

1.2.5 Culverts

All but three of the culverts located along the Stoughton Line are located within the inactive right-of-way and therefore they will be constructed as resources allow. Culvert CV-ST- 2.47 and CV-ST- 3.40 are located north of Stoughton Station and will be restored if required. The culvert CV-ST-19.10 is located south of Winter Street and will have to be reconstructed in stages during track outages and over extended weekends. MCRR will coordinate with customers to consolidate freight shipments to minimize weekday deliveries and provide longer weekend windows for construction. This work can be scheduled in conjunction with the track outages for the nearby bridge work as discussed on pages 2 through 9. Culverts along the Stoughton Line include the following:

- MP 2.47 CV-ST- 2.47
- MP 3.40 CV-ST- 3.40
- MP 4.49 CV-ST-4.49
- MP 4.94 CV-ST-4.94
- MP 5.04 CV-ST-5.04
- MP 5.26 CV-ST-5.26
- MP 5.45w CV-ST-5.45w
- MP 5.53w CV-ST-5.53w
- MP 5.94 CV-ST-5.94
- MP 6.45 CV-ST-6.45
- MP 6.83 CV-ST-6.83
- MP 7.06 CV-ST-7.06
- MP 7.21 CV-ST-7.21
- MP 7.23 CV-ST-7.23
- MP 7.42 CV-ST-7.42
- MP 9.22 CV-ST-9.22
- MP 9.35 CV-ST-9.35
- MP 10.05 CV-ST-10.05
- MP 10.23 CV-ST-10.23
- MP 10.41 CV-ST-10.41
- MP 10.90 CV-ST-10.90
- MP 10.95 CV-ST-10.95
- MP 11.11 CV-ST-11.11
- MP 11.23 CV-ST-11.23

- MP 11.33 CV-ST-11.33
- MP 11.34 CV-ST-11.34
- MP 11.44 CV-ST-11.44
- MP 11.59 CV-ST-11.59
- MP 11.61 CV-ST-11.61
- MP 11.65 CV-ST-11.65
- MP 11.91 CV-ST-11.91
- MP 12.09 CV-ST-12.09
- MP 12.38 CV-ST-12.38
- MP 12.68 CV-ST-12.68
- MP 12.99 CV-ST-12.99
- MP 13.12 CV-ST-13.12
- MP 13.42 CV-ST-13.42
- MP 14.02 CV-ST-14.02
- MP 14.1E CV-ST-14.1E
- MP 15.4E CV-ST-15.4E
- MP 15.4w CV-ST-15.4w
- MP 15.80 CV-ST-15.80
- MP 16.00 CV-ST-16.00
- MP 16.46E CV-ST-16.46E
- MP 16.73 CV-ST-16.73
- MP 17.37 CV-ST-17.37
- MP 17.96 CV-ST-17.96
- MP 18.18 CV-ST-18.18
- MP 19.10 CV-ST-19.10
- MP 19.41 CV-ST-19.41

1.2.6 Track

In general, track construction staging will support the construction staging and schedule of the nearest bridge under construction. Track construction along inactive rail lines will proceed as resources allow. The construction of track sidings can be completed with minimal disruption to freight service.

Inactive Right-of-Way

- Construct northerly section of new track in final position along the west side of right of way from Station 1020+00 to 1190+70.
- Construct southerly section of new track in final position along the east side of right of way from Station 1250+30 to 1780+80.
- Construct new sidings in final position along the east side of right of way from Station 1517+78 to 1632+16
- Relocate existing power line along the right-of-way within Pine Swamp to provide adequate clearance to the proposed catenary.
- Install interlocking track components, including two Track 1 to 2 crossovers, from Station 1041+00 to 1052+00

Active Right-of-Way

- Shift and connect existing Track 1 to Track 2:
  - Station 798+17 to 1145+56.
  - Station 1753+85 to 1784+95
  - Station 17886+70 to 1810+22
- Install Weir Junction interlocking track components from Station 1846+75 to 1872+54, including one crossover between High Street and Ingell Street, three yard tracks, connections to existing yard tracks and the connection to the Attleboro Line.
- Restore passenger and freight service.

1.3 New Bedford Main Line

This project will include the reconstruction of the New Bedford Main Line between Weir Junction and New Bedford. This line has active freight service operated by CSX between Weir Junction and Cotley Junction, and by MCRR between Weir Junction and New Bedford.

1.3.1 Retaining Walls

Construct retaining walls to the extent possible without affecting existing rail service. Retaining walls are proposed along approximately 8,100 track feet.

- Station 1990+00 to 1993+00
- Station 2020+00 to 2024+00
- Station 2176+00 to 2179+00
- Station 2280+00 to 2286+00

- Station 2525+00 to 2529+00
- Station 2674+00 to 2678+00
- Station 2752+00 to 2772+00
- Station 2787+00 to 2793+00
- Station 2814+00 to 2842+00
- Station 2849+00 to 2852+00

1.3.2 Grade Crossings

Reconstruct grade crossings or close existing crossings to the extent possible during off peak hours with a flagman and during weekend track outages. Active grade crossings that are proposed to be closed cannot be dismantled/blocked until the proposed alternative access has been constructed.

- MP 35.46 Ingell Street (Maintain)
- MP 35.98 Hart Street (Maintain)
- MP 36.48 Silva Crossing (Maintain)
- MP 37.81 W. Stevens Street (Maintain)
- MP 38.34 Cotley Street (Maintain)
- MP 38.47 Private Crossing (CLOSE)
- MP 38.57 Private Crossing (CLOSE)
- MP 39.85 Padelford Street (Maintain)
- MP 40.52 Myricks Street (Maintain)
- MP 40.96 Malbone Street (Maintain)
- MP 41.34 Obed Crossing (CLOSE)
- MP 42.39 Crossing Planks (CLOSE)
- MP 42.78 Private Crossing (CLOSE)
- MP 42.99 Gravel Bank (CLOSE)
- MP 43.09 Private Crossing (CLOSE)
- MP 43.41 Private Crossing (CLOSE)
- MP 43.56 Stonewall Crossing (CLOSE)
- MP 43.98 Jeep Crossing (CLOSE)
- MP 44.17 Jeep Crossing (CLOSE)
- MP 44.36 Townline Crossing (CLOSE)
- MP 45.09 Pierce Gravel Pit (CLOSE)
- MP 45.51 Gas Line (CLOSE)
- MP 45.62 Chace Road (Maintain)
- MP 46.06 Private Road (CLOSE)

➤ MP 46.30	Private Road	(CLOSE)
➤ MP 46.37	Lucas Crossing	(CLOSE)
➤ MP 46.66	Lawrence Crossing	(CLOSE)
➤ MP 47.24	Braley Road	(Maintain)
➤ MP 47.35	Occupation Crossing	(CLOSE)
➤ MP 47.44	Pittsley Crossing	(CLOSE)
➤ MP 47.84	East Chipaway Road	(Maintain)
➤ MP 48.21	Private Road	(Maintain)
➤ MP 49.03	Samuel Barnet Rd.	(Maintain)
➤ MP 49.10	Polaroid Crossing	(CLOSE)
➤ MP 49.41	Private Crossing	(CLOSE)
➤ MP 51.17	Pig Farm Road	(Maintain)
➤ MP 51.93	Tarkiln Hill Road	(Maintain)
➤ MP 52.91	Nash Road	(Maintain)

1.3.3 Stations

The following stations will be constructed along the New Bedford Main Line:

- Taunton Depot
- King's Highway
- Whales Tooth Station

1.3.4 Bridges

Bridge reconstruction along the New Bedford Main Line will follow the bridge construction sequencing outlined on pages 2 through 9 as dictated by the number of existing and proposed tracks. Bridge staging will take precedence over track staging with consideration for nearby structures, property limits and wetland boundaries. The work will be sequenced in order to minimize impacts local traffic.

One Existing Track - Two Proposed Tracks

The following single track bridges along the New Bedford Main Line will be reconstructed to support a 2-track cross section.

- MP BR 35.56 (Station 1877+55) Taunton River
- MP BR 35.79 (Station 1889+50) Brickyard Road
- MP BR 38.93 (Station 2055+67) Cotley River
- MP BR 39.46 (Station 2083+69) Cotley river

One Existing Track - One Proposed Track

The following single track bridges along the New Bedford Main Line will be reconstructed to provide a new single track bridge.

- MP BR 42.14 (Station 2225+16) Assonet River
- MP BR 45.43 (Station 2398+96) Fall Brook
- MP BR 54.17 (Station 2860+00) Route 18
- MP BR 54.21 (Station 2862+50) Wamsutta Street

The alignment and physical constraints of the existing undergrade railroad bridges at Route 18 and Wamsutta Street in New Bedford make it extremely difficult and costly to maintain rail service during construction. MBTA and MCRR will coordinate with the freight customer(s) in New Bedford to provide an alternative means of transportation for an extended period to deliver freight while the bridges are under construction.

1.3.5 Culverts

The existing culverts along the New Bedford Main Line will be reconstructed in stages during track outages and over extended weekends. MCRR will coordinate with customers to consolidate freight shipments to minimize weekday deliveries and provide longer weekend windows for construction. This work can be scheduled in conjunction with the track outages for the nearby bridge work as discussed on pages 2 through 9. Culverts along the New Bedford Main Line include the following:

- MP 17.89 CV-NB-17.89
- MP 19.69 CV-NB-19.69w
- MP 20.37 CV-NB-20.37
- MP 20.78 CV-NB-20.78
- MP 20.89 CV-NB-20.89
- MP 21.51 CV-NB-21.51
- MP 21.61 CV-NB-21.61
- MP 21.68 CV-NB-21.68
- MP 24.08 CV-NB-24.08
- MP 24.31 CV-NB-24.31
- MP 26.47 CV-NB-26.47
- MP 26.68 CV-NB-26.68
- MP 26.96 CV-NB-26.96
- MP 27.43 CV-NB-27.43
- MP 12.0 CV-NB-12w
- MP 14.52 CV-NB-14.52
- MP 14.74 CV-NB-14.74

- MP 15.01 CV-NB-15.01
- MP 16.4 CV-NB-16.4
- MP 16.89 CV-NB-16.89
- MP 22.24 CV-NB-22.24
- MP 22.52 CV-NB-22.52
- MP 22.58 CV-NB-22.58
- MP 22.71 CV-NB-22.71
- MP 22.84 CV-NB-22.84
- MP 23.65 CV-NB-23.65
- MP 28.47 CV-NB-28.47
- MP 28.60 CV-NB-28.60
- MP 28.87 CV-NB-28.87

1.3.6 Track

In general, track construction staging will support the construction staging and schedule of the nearest bridge under construction. Track construction along inactive rail lines will proceed as resources allow. The construction of track sidings can be done with minimal disruption to freight service. Environmental commitments may limit hours of construction to daytime only.

Construct sidings along the east side of right of way

- Station 1879+00 to 2180+00
- Station 2420+08 to 2515+63
- Station 2748+62 to 2839+33

Construct Wamsutta Layover Yard, Station 2881+36

Clear and grub,

Excavate, construct subgrade, install drainage, construct pavement,

Install tracks, connect to mainline track and place into service.

Track construction within the active right-of-way.

- Shift and connect existing Track 1 to Track 2:
- Install interlocking track components, including two crossovers, at the connection to the Fall River Secondary.
- Install interlocking track components, including two crossovers, from station 2870+00 to station 2840+00 in New Bedford.

- Install mainline track on existing track bed from station 1877+55 (north of Taunton River Bridge) to station 2180+00 south of the Fall River connection after sidings and second main tracks have been constructed.

1.4 Fall River Secondary

This project will reconstruct the Fall River Secondary between Myricks Junction and Fall River. This line has active freight service operated by MCRR between Myricks Junction and Fall River.

1.4.1 Retaining Walls

Construct retaining walls to the extent possible without affecting existing rail service. Retaining walls are proposed along approximately 21,000 track feet.

- Station 2158+00 to 2162+00
- Station 2188+00 to 2198+00
- Station 2203+00 to 2208+00
- Station 2224+00 to 2227+00
- Station 2234+00 to 2240+00
- Station 2259+00 to 2273+00
- Station 2280+00 to 2282+00
- Station 2433+00 to 2447+00
- Station 2457+00 to 2462+00
- Station 2490+00 to 2498+00
- Station 2511+00 to 2521+00
- Station 2568+00 to 2587+00
- Station 2598+00 to 2603+00
- Station 2625+00 to 2631+00
- Station 2638+00 to 2700+00
- Station 2710+00 to 2716+00
- Station 2720+00 to 2751+00

1.4.2 Grade Crossings

Reconstruct grade crossings or close existing crossings to the extent possible during off peak hours with a flagman and during weekend track outages. Active grade crossings that provide the single access to a property will be maintained, until the proposed alternative access has been constructed.

- MP 0.2 Mill Street CLOSE
- MP 0.4 Private Road CLOSE
- MP 0.6 Adams Lane CLOSE
- MP 0.8 Private Road CLOSE
- MP 0.9 Private Road CLOSE
- MP 1.2 Beechwood Street CLOSE
- MP 1.3 Richmond Road – North Maintain
- MP 2.0 Private Road CLOSE
- MP 2.3 Private Road CLOSE
- MP 2.4 Forge Road -North CLOSE
- MP 2.4 Richmond Road – South Maintain
- MP 2.7 Forge Road - South Maintain
- Farm Crossing CLOSE
- MP 3.0 Elm Street Maintain
- Farm Crossing CLOSE
- MP 3.7 High Street Maintain
- MP 4.5 Private Road CLOSE
- MP 4.7 Copicut Road Maintain
- MP 5.6 Brightman Lumber Maintain
- Former Private Crossing N/A
- Former Farm Crossing N/A
- Farm Crossing CLOSE
- Farm Crossing CLOSE
- Golf Service Road - North CLOSE
- ATV Crossing CLOSE
- Private Crossing CLOSE
- Private Road CLOSE
- Dirt Crossing CLOSE
- MP 9.0 Private Road CLOSE

1.4.3 Stations

The following stations will be constructed along the Fall River Secondary:

- Freetown
- Fall River Depot
- Battleship Cove

1.4.4 Bridges

Bridge reconstruction along the Fall River Secondary will follow the construction sequencing outlined on pages 2 through 9 depending on the number of existing and proposed tracks. Bridge staging and scheduling will take precedence over track staging requirements/needs with respect to nearby structures, right-of-way constraints and wetland boundaries. The work will be sequenced to minimize impacts to local traffic to the extent possible.

One Existing Track - Two Proposed Tracks

The following existing single track bridges along the Fall River Secondary will be expanded to support a 2-track cross section.

- UG BR 10.57 (Station 2704+00.00) Pearce Street - the existing span is new and does not have to be replaced.
- UG BR 10.77 (Station 2714+50.00) Turner Street – the existing span is new and does not have to be replaced.

One Existing Track - One Proposed Track

The following single track bridges along the Fall River Secondary will be reconstructed to provide a new single track bridge.

- UG BR 0.92 (Station 2192+07) Cedar Swamp
- UG BR 5.93 (Station 2457+35.00) Farm Road
- UG BR 6.77 (Station 2501+00.00) Farm Road – remove and backfill
- UG BR 6.92 (Station 2529+61.20) Golf Cart Road
- UG BR 7.13 (Station 2540+70.00) Golf Club Road
- UG BR 7.98 (Station 2567+50.00) Miller's Cove Road
- UG BR 8.42 (Station 2590+70.00) Collins Street
- UG BR 8.58 (Station 2599+00.00) Ashley's Underpass (Ashley Street)
- UG BR 10.40 (Station 2695+00.00) Brownell Street
- UG BR 10.48 (Station 2699+00.00) President's Avenue

1.4.5 Culverts

The existing culverts along the Fall River Secondary will be reconstructed in stages during track outages and over extended weekends. MCRR will coordinate with customers to consolidate freight shipments to minimize weekday deliveries and provide longer weekend windows for construction. This work can be scheduled in conjunction with the track outages for the nearby bridge work as discussed on pages 2 through 9. Culverts along the Fall River Secondary include the following:

- MP 0.42 CV-FR-0.42
- MP 0.58+- MP 0.58+-
- MP 1.14 CV-FR-1.14
- MP 1.20 CV-FR-1.20
- MP 1.47 CV-FR-1.47
- MP 1.59 CV-FR-1.59
- MP 1.76 CV-FR-1.76
- MP 2.13 CV-FR-2.13
- MP 2.21 CV-FR-2.21
- MP 2.71 CV-FR-2.71
- MP 2.95 CV-FR-2.95
- MP 4.50 CV-FR-4.50
- MP 5.49 CV-FR-5.49
- MP 5.55E CV-FR-5.55E
- MP 5.62 CV-FR-5.62
- MP 5.68 CV-FR-5.68
- MP 5.72 CV-FR-5.72
- MP 5.79 CV-FR-5.79
- MP 6.86 CV-FR-6.86
- MP 7.11 CV-FR-7.11
- MP 7.24 CV-FR-7.24
- MP 7.31 CV-FR-7.31
- MP 7.58 CV-FR-7.58
- MP 8.97 CV-FR-8.97
- MP 9.28 CV-FR-9.28
- MP 11.43 CV-FR-11.43
- MP 11.65 CV-FR-11.65

1.4.6 Track

In general, track construction staging will support the construction staging and schedule of the nearest bridge under construction. Track construction along inactive rail lines will proceed as resources allow. The construction of track sidings can be done with minimal disruption to freight service.

Construct new sidings in final position along the east side of right of way:

- from Station 2441+38 to 2410+59
- from Station 2501+92 t 2556+60
- from Station 2700+61 to 2718+47

Construct Weavers Cove Layover Yard, Station 2025+52

- Clear and grub,
- Excavate, construct subgrade, install drainage, construct pavement,
- Install tracks, connect to mainline track and place into service.

Track Construction within the active right-of-way

- Install interlocking track components, including two crossovers.
- Connect to the Fall River Secondary at Myricks Junction.
- Install interlocking track components from station 2740+00 to station 2770+00 in Fall River.

2

Bridge Access and Laydown Summary

2.1 Stoughton Line Bridges

The following locations have been identified for access and construction laydown for the reconstruction of bridges along the Stoughton Line as part of the South Coast Rail project.

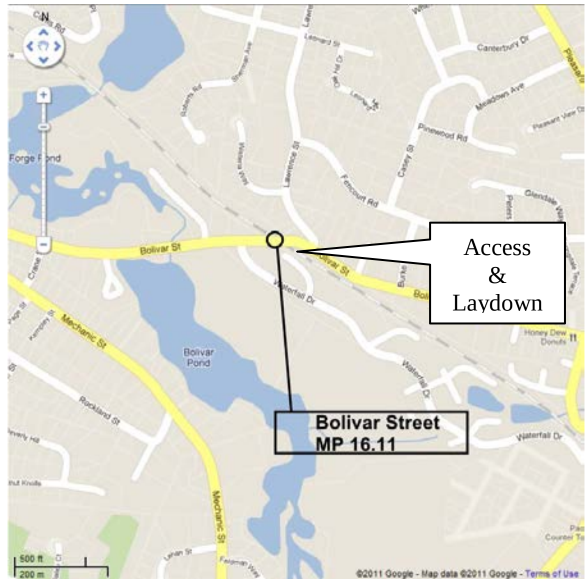
2.1.1 Kingsley Pond (Forge Pond), Canton

This site is accessible 0.22 miles west at Washington Street or 0.32 miles west at Ames Ave. Space for a lay-down area may be available behind 230 Bolivar Street.

This bridge can be constructed at any time. The staging will include the construction of a new single track bridge adjacent to the existing bridge while maintaining rail service on the existing bridge. Rail service will then be shifted to the new bridge while the existing bridge is reconstructed. Material will have to be carried in over active track. The existing bridge rating is unknown, however based on current traffic the existing bridge could carry limited construction related traffic. The construction of this bridge should be sequenced with the Bolivar Street and Mill Brook bridges.

2.1.2 Bolivar Street, Canton

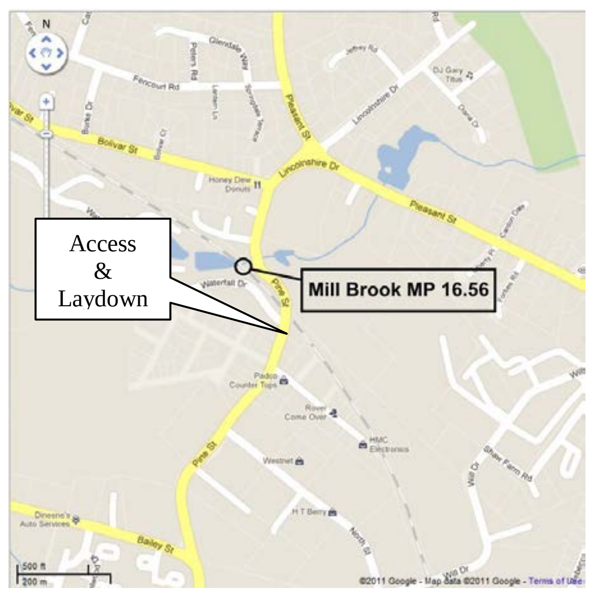
This site is accessible from Bolivar Street or from 333 Bolivar Street at Waterfall Drive to the east where laydown space is also available.



This bridge can be constructed any time. The staging will include the construction of a new single track bridge adjacent to the existing bridge while maintaining rail service on the existing bridge. Rail service will then be shifted to the new bridge while the existing bridge is reconstructed. Material will have to be carried in over active track. The existing bridge is rated below Cooper E80. Based on the load capacity rating and current traffic, the existing structure could carry limited construction related traffic to construct other bridges on the line. The construction of this bridge should be sequenced with the construction of the Kingsley Pond and Mill Brook bridges.

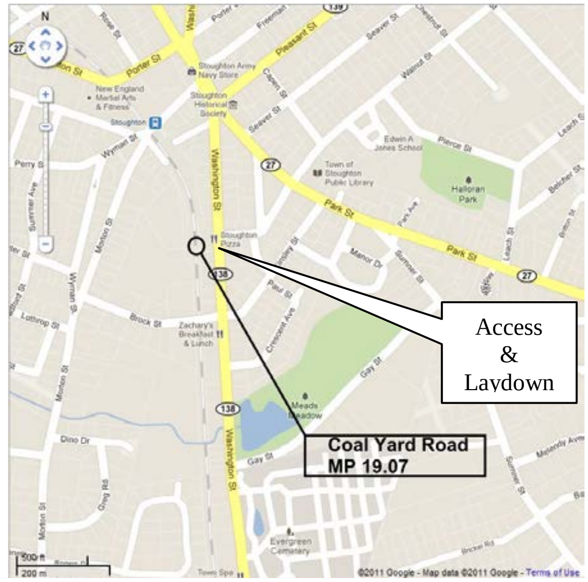
2.1.3 Mill Brook, Canton

Access and lay-down are available 434 feet east at Pine Street.



This bridge can be constructed at any time. The existing bridge currently carries a single track for commuter rail traffic. The staging will include the construction of a new single track bridge adjacent to the existing bridge while maintaining rail service on the existing bridge. Rail service will then be shifted to the new bridge while the existing bridge is reconstructed. Material will have to be carried in over active track. The existing bridge rating is unknown, however based on current traffic the existing bridge could carry limited construction related traffic. The construction of this bridge should be sequenced with the reconstruction of the Bolivar Street and Kingsley Pond bridges.

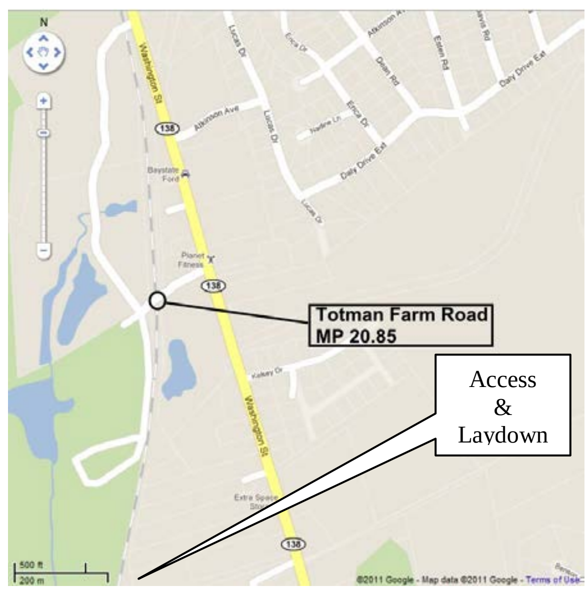
2.1.4 Coal Yard Road, Stoughton



Access and space for lay-down for this bridge are available 165 feet east at 893 Washington Street/Route 138.

This bridge can be constructed at any time. Phased construction would include replacing each span separately while maintaining rail service on one of the other structures. The existing bridge is rated below Cooper E80, but currently carries commuter train traffic. Based on the rating and current rail traffic, the existing bridge could be used for limited construction related traffic. The Stoughton line south of this bridge is abandoned and this bridge will not be used for construction access to other bridges.

2.1.5 Totman Farm Road, Stoughton



This bridge is accessible from Totman Farm Road via Washington Street or 0.37 mile south from 2031-2183 Washington Street, where space is available for laydown.

This bridge could be constructed at any time. However, this location could be used to access the right of way and other locations to the south. The existing bridge is out of service and the superstructure has been removed. The right of way could be accessed from this location once the existing abutments are removed. The new bridge would then be constructed once access from this location is no longer required. Totman Farm Road will be used as primary access for the Morton Street frontage road.

2.1.6 Day's Farm Road, Easton

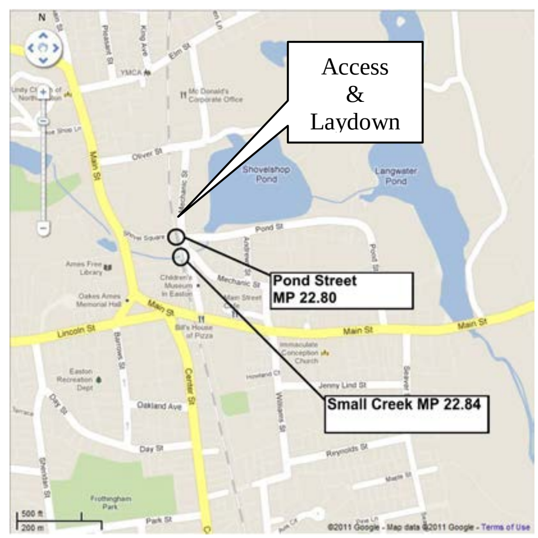
This site is accessible from the north via Totman Farm Road or 0.33 miles north from the shopping and office complex at 25 Washington Street, where laydown space is available.

The Days Farm Bridge will have to be reconstructed first to provide access to Cowessett Brook.

2.1.7 Cowessett Brook, Easton

The site is accessible from Totman Farm Road to the north or 0.45 miles north from the shopping complex at 25 Washington Street, where laydown space is available. Day's Farm Road Bridge will have to be constructed before this bridge to provide construction access along the right-of-way. Access is also available 0.85 miles south from Elm Street.

2.1.8 Pond Street, Easton



This site is accessible from Shovel Shop Square to the west and from the corner of Pond Street and Mechanic Street to the east. Lay-down space may be available in the area north of Shovel Shop Square.

This bridge can be constructed at any time without relying on construction of other bridges. This bridge should be constructed prior to the construction of the Small creek bridge if it is to be used to transport construction materials and equipment.

2.1.9 Small Creek, Easton

This site is accessible from Sullivan Street and Mechanic Street to the north. Lay-down space may be available in the vicinity north of Shovel Shop Square.

This bridge should be constructed after Pond Street if it is to be used to transport of construction materials and equipment.

2.1.10 Main Street, Easton

This site is accessible from Main Street or along Sullivan Avenue. Lay-down space may be available in the area north of Shovel Shop Square or at the rear of the parking area behind 101 Main Street.

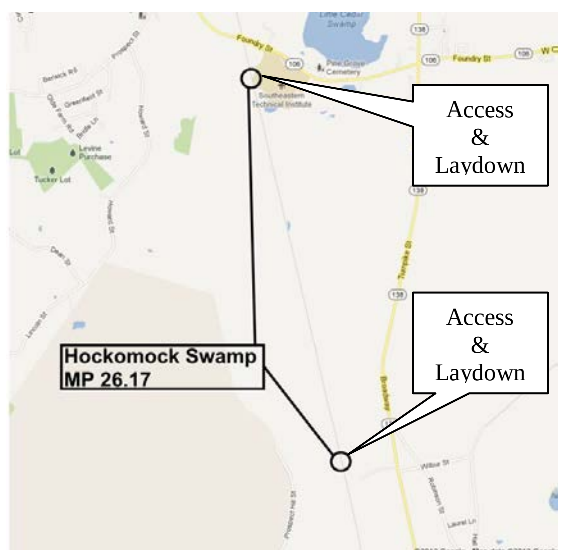
This bridge can be constructed at any time as it is located within the inactive portion of the right-of-way; however, this bridge should not be constructed at the same time as Bridge Street as one road will be the detour for the construction of the other.

2.1.11 Bridge Street, Easton

This site is accessible from Bridge Street or 425 feet north from Williams Street. Lay-down space may be available 0.54 miles north in the vicinity of Shovel Shop Square or 0.23 mile north at the rear of the parking area behind 101 Main Street.

This bridge can be constructed at any time, except during the construction of the Main Street Bridge.

2.1.12 Hockomock Swamp Trestle, Raynham

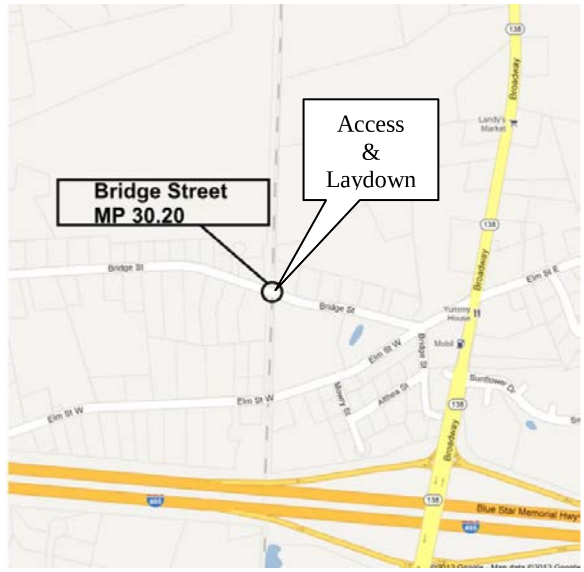


Access and lay-down are available to the north from the Vocational School and Foundry Street and to the south from the Race Track crossing.

The Hockomock Swamp Trestle construction will be completed working from the north and south using two crews. The staging is described on pages 13 and 14 of this report.

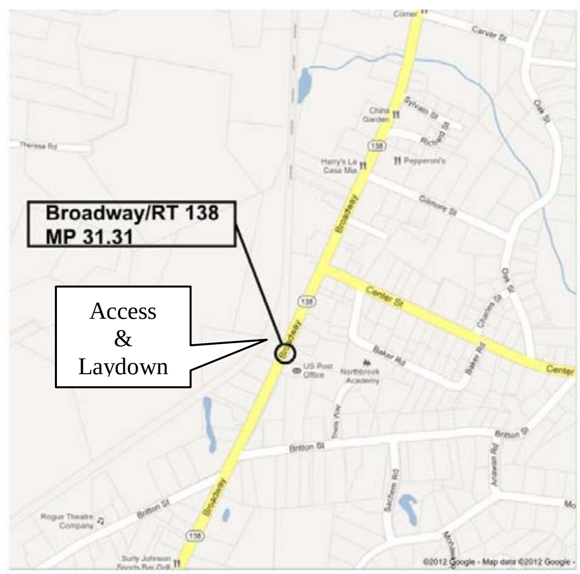
2.1.13 Bridge Street, Raynham

This site is accessible from Bridge Street or 0.14 miles south from Elm Street. Laydown space is available at the Race Track crossing, 1.07 miles north. This bridge can be constructed at any time. The roadway bridge construction over the inactive rail will not affect work in other locations.

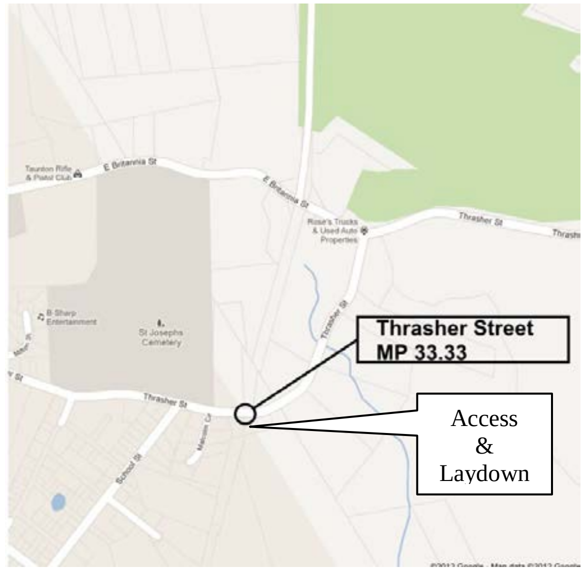


2.1.14 Route 138 Grade Separation, Raynham

This site is accessible from Route 138. Lay-down space is available in the rear of 728 Broadway or 686 Broadway along the Whittenton Branch ROW. This bridge can be constructed at any time. The roadway bridge construction over the future rail right-of-way will not affect work in other locations.



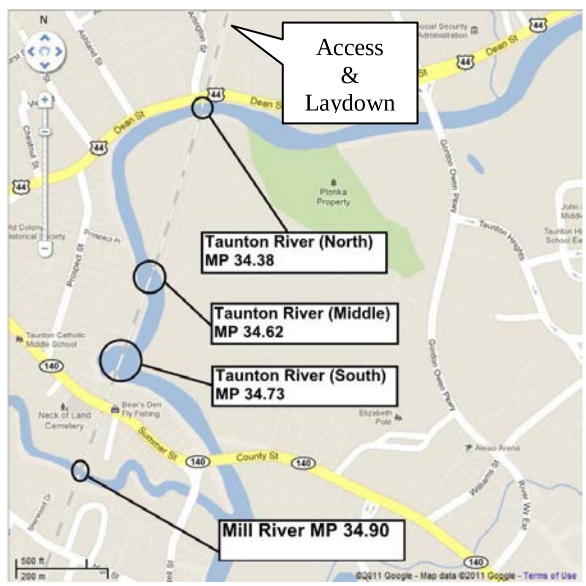
2.1.15 Thrasher Street, Raynham



This site is accessible from Thrasher Street. or 0.29 miles north from East Britannia Street or 0.50 miles south from Longmeadow Road, where space is available for laydown.

This bridge can be constructed at any time. The roadway bridge construction over the inactive rail will not affect work in other locations.

2.1.16 Taunton River (North), Taunton



This site is accessible from Dean Street. Space for lay-down is available 0.17 miles north at William Hooke Lane.

The bridge near Dean Street can be constructed at any time, but should be sequenced with the other Taunton River and Mill River bridges to the south. The proposed bridge will be constructed using accelerated methods, weeknights 7:00 PM to 7:00 AM, weekends 7:00 PM on Friday to 7:00 AM on Monday and as allowed by MCRR. Shipments will be coordinated with MCRR customers to provide one extended (5 or 6 day) weekend service shutdown per month to roll in the superstructure. Roadway work on Dean Street will be staged to minimize traffic impacts. The existing bridge structure is rated below Cooper E-80, but currently carries freight traffic and could carry limited construction related traffic. This bridge should be reconstructed in sequence from north to south with the two bridges to the south for construction access to the other sites.

2.1.17 Taunton River (Middle), Taunton

This site is accessible from Dean Street. Lay-down space is available 0.42 miles north at William Hooke Lane.

The middle bridge can be constructed at any time, but should be sequenced with the other Taunton River crossings to the north and south The proposed bridge will be constructed using accelerated methods, weeknights 7:00 PM to 7:00 AM, weekends 7:00 PM on Friday to 7:00 AM on Monday and as allowed by MCRR. Shipments will be coordinated with MCRR customers to provide one extended (5 or 6 day) weekend service shutdown per month to role in the superstructure. The existing bridge structure is rated below Cooper E-80, but currently carries freight traffic and could carry limited construction related traffic. This bridge should be constructed in sequence with the bridge to the north and south for construction access to the other sites.

2.1.18 Taunton River (South), Taunton

This site is accessible from Dean Street. Lay-down space is available 0.53 miles north at William Hooke Lane.

The southern bridge can be constructed at any time, but should be sequenced with the other Taunton River crossings to the north and the mill river crossing to the south. The proposed bridge will be constructed using accelerated methods weeknights 7:00 PM to 7:00 AM, weekends 7:00 PM on Friday to 7:00 AM on Monday and as allowed by MCRR. Shipments will be coordinated with MCRR customers to provide one extended (5 or 6 day) weekend service shutdown per month to roll in the superstructure. The existing bridge structure does not rate for Cooper E-80, but currently carries freight traffic. Based on the bridge rating, the bridge has limited capacity and should be reconstructed before it can carry construction traffic.

2.1.19 Mill River, Taunton

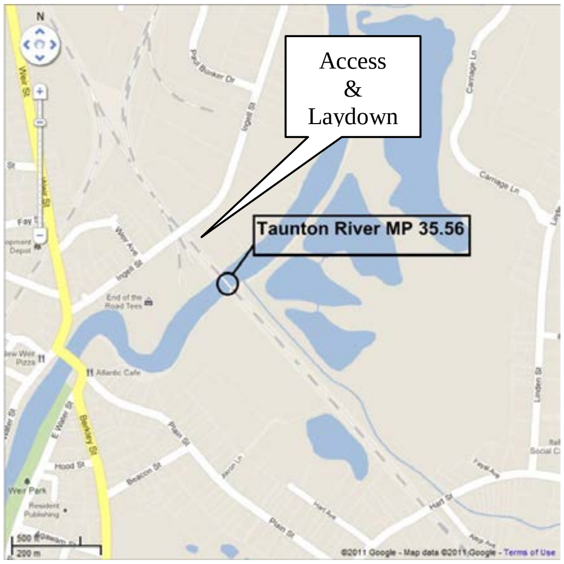
The site is accessible from Dean Street. Lay-down space is available 0.72 miles north at William Hooke Lane.

This bridge can be constructed at any time, but should be sequenced with the other Taunton River crossings to the north. The proposed bridge will be constructed using accelerated methods, weeknights 7:00 PM to 7:00 AM, weekends 7:00 PM on Friday to 7:00 AM on Monday and as allowed by MCRR. Shipments will be coordinated with MCRR customers to provide one extended (5 or 6 day) weekend service shutdown per month to erect the preassembled superstructure. The existing bridge structure is rated below Cooper E-80, but currently carries freight traffic and could carry limited construction related traffic. Where construction access is required from the north, this bridge should be constructed after the other Taunton River crossings to the north to allow the transport of construction materials and equipment.

2.2 New Bedford Main Line Bridges

The following locations have been identified for access and construction laydown for the reconstruction of bridges along the New Bedford Main Line as part of the South Coast Rail project.

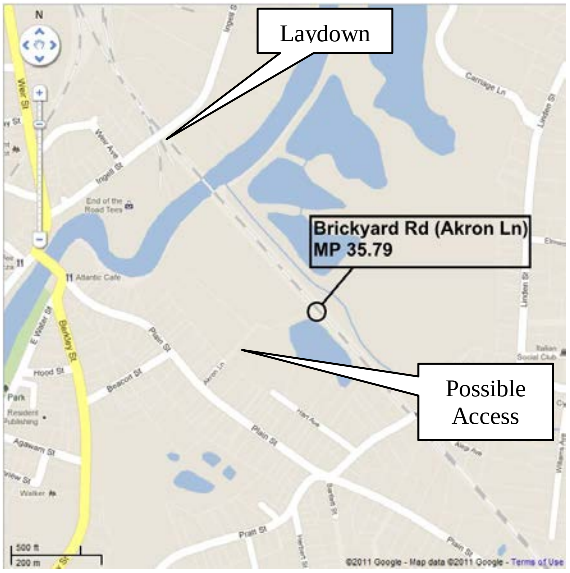
2.2.1 Taunton River, Taunton



The access and lay-down for this site are 490 feet northwest of the site at Ingell Street.

This bridge can be constructed at any time. The staging will include the construction of a new one track bridge adjacent to the existing bridge while maintaining rail service on the existing bridge. Rail service will have to be shifted to the new bridge to reconstruct the existing bridge. Construction material and equipment will have to be carried in over the active track. The existing bridge is rated for E64 loading, but is able to handle construction related traffic to construct other bridges to the south. The steel through-plate-girder bridge can be constructed one track at a time with three girders. The center girder will support both tracks.

2.2.2 Brickyard Road, Taunton



This site is seasonally flooded under the bridge. The site is accessible from Plain Street and Akron Lane 670 feet west of the site via the abandoned road or 0.25 miles south at the Hart Street grade crossing. A lay-down area for this site is located 0.30 miles northwest at Ingell Street.

This bridge can be constructed at any time. The staging will include the construction of a new single track bridge adjacent to the existing bridge while maintaining rail service on the existing bridge. After shifting service to the new bridge, the existing bridge can be reconstructed. Construction material and equipment will have to be carried in over active track. The existing bridge is rated for E97 loading, and could carry construction related traffic to construct other bridges on the line. The proposed prestressed box girder bridge would require post tensioning in each phase.

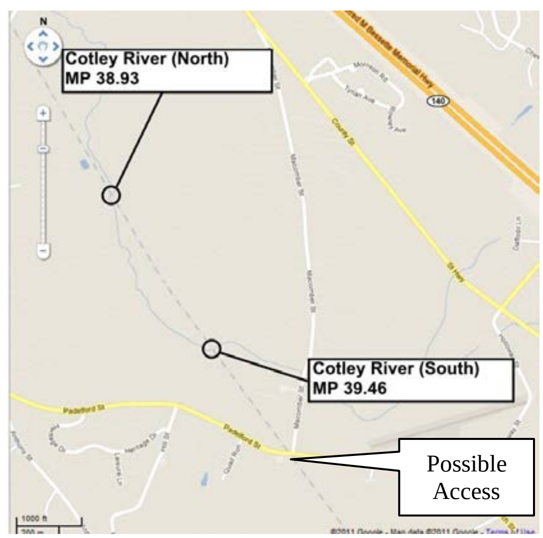
2.2.3 Route 24, Taunton

This site is accessible from Route 24. Access and lay-down at rail grade are available from the east at the Galleria Mall. The access road heads 0.15 miles southwest from Galleria Mall Drive to the right-of-way at a point 0.11 miles from the overhead crossing (0.26 miles total).

This bridge can be constructed at any time. Construction staging would not significantly affect rail service as this is a roadway bridge. This bridge has to be constructed before the tracks can be constructed below.

2.2.4 Cotley River (North), Berkley

This site is accessible from Cotley Street, 0.59 miles north of the site or 0.90 miles south from Padelford Street via the Cotley River South Bridge. This site is also accessible from Galleria Mall Road, 1.12 miles north where space for lay-down is also available.



This bridge can be constructed at any time. The staging will include the construction of a new single track bridge adjacent to the existing bridge while maintaining rail service on the existing bridge. Rail service can then be shifted to the new bridge while the existing bridge is reconstructed. This will require material to be carried in over active track. The existing bridge and the Cotley River crossing to the south both accommodate Cooper E78 loading. Based on the strength rating and current rail traffic the existing bridge structures could carry construction related traffic. The Cotley River bridges should be constructed sequentially if it is required to use one bridge as access for the other.

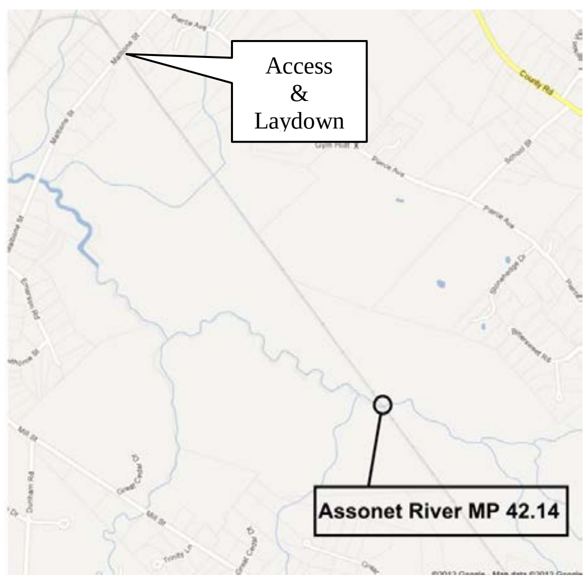
2.2.5 Cotley River (South) , Berkley

This site is accessible 0.40 miles south at Padelford Street and 1.12 miles north at Cotley Street via the Cotley River North Bridge. A potential lay-down area is located 1.66 miles north at the Galleria Mall Road access.

This bridge can be constructed at any time. The staging will include the construction of a new single track bridge adjacent to the existing bridge while maintaining rail service on the existing bridge. Rail service can then be shifted to the new bridge while the existing bridge is reconstructed. The existing bridge and the Cotley River crossing to the north both accommodate Cooper E78 loading. Based on the strength rating and current rail traffic the existing bridge structures could carry construction related traffic. The Cotley River bridges should be constructed sequentially, as each bridge will provide access to the next.

2.2.6 Assonet River (Cedar Swamp), Lakeville

This site is accessible from Malbone Street, 1.19 miles north and 1.11 miles south from Howland Road. The Howland Road access is steep and would require an easement over private property. Lay-down and access are also available 1.63 miles northwest in the vicinity of Myricks Street and Grove Street at Myricks Junction.



This bridge can be constructed at any time. Widening the proposed structure to accommodate rail service during construction will require material to be carried in over active track. The existing timber bridge was recently reconstructed, rated for Cooper E78 loading and could carry construction related traffic.

2.2.7 Fall Brook (Freetown Brook), Freetown

This site is accessible from Chace Road, 0.17 miles south.

This bridge can be constructed at any time; however the existing bridge is not able to carry construction traffic. Widening the proposed structure to accommodate rail service during construction will require material to be carried in over active track. The existing bridge is rated at Cooper E51 loading, and is currently carrying freight traffic. Based on the bridge rating, the bridge has limited capacity and should be reconstructed before it can carry construction traffic.

2.2.8 Route 18, New Bedford

Access and lay-down for this site are available to the west side of 1750 Purchase Street.

This bridge is to be constructed as a three-span bridge including the span over Wamsutta Street, and can be constructed at any time. Alternative transportation will have to be provided to the MCRR customer to the south so the bridges can be closed for reconstruction. The Wamsutta Street Bridge will have to be replaced before it can accommodate construction traffic.

2.2.9 Wamsutta Street, New Bedford

Access and lay-down for this site is available from the rail yard immediately to the east.

This bridge is to be constructed as a three span bridge including the two spans over Route 18, and can be constructed at any time. Alternative transportation will have to be provided to the MCRR customer to the south so the bridges can be closed for reconstruction. This bridge is in poor condition and has a rated capacity of E55. This bridge would have to be reconstructed before it will be able to carry construction related traffic.

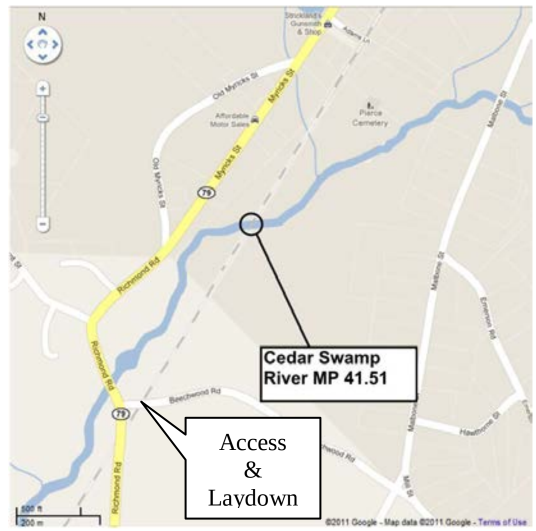
2.3 Fall River Secondary Bridges

The following locations have been identified for access and construction laydown for the reconstruction of bridges along the Fall River Secondary as part of the South Coast Rail project.

2.3.1 Cedar Swamp River (Assonet River), Lakeville

Access and lay-down for this site are available 0.31 miles south at Beechwood Road. Access is also available through private property on Adams Lane, 0.33 miles to the north.

This bridge can be constructed at any time. The proposed bridge will be constructed using accelerated methods weeknights 7:00 PM to 7:00 AM, weekends 7:00 PM on Friday to 7:00 AM on Monday and as allowed by MCRR. The existing bridge is rated below Cooper E80, and is currently carrying freight traffic. The bridge should be reconstructed before it can be used for construction traffic.



2.3.2 Farm Road (North), Freetown

Access and lay-down for the bridge are available 0.63 miles to the north at the abandoned rail yard located at 178-188 South Main Street. The site is also accessible 0.6 miles south from the Farm Road at M.P. 47.75. A temporary access easement would be required to gain access from the industrial plant service road to the south as well as from Farm Road.

This bridge can be constructed at any time. Widening the proposed structure to accommodate rail service during construction will require material to be carried in over active track. The existing steel bridge is rated below Cooper E80. Based on the rating capacity and current freight traffic the existing bridge could carry limited construction related traffic.

2.3.3 Farm Road (South), Fall River

The site is accessible from Golf Cart Road, 0.54 miles south. Access is also available 0.15 miles east from Horizon Way/Point West Drive via Farm Road. The abandoned rail yard located 1.48 miles northeast of the bridge site may provide an acceptable laydown area via the Farm Road North Bridge.

This bridge construction could commence at any time. Filling Operations would require work around scheduled track outages. This bridge is rated for E73 loading, and currently carries freight traffic. The existing bridge could carry construction related traffic.

2.3.4 Golf Cart Road, Fall River

Access and lay-down for this site is available 0.21 miles south at Golf Club Road (M.P. 48.11).

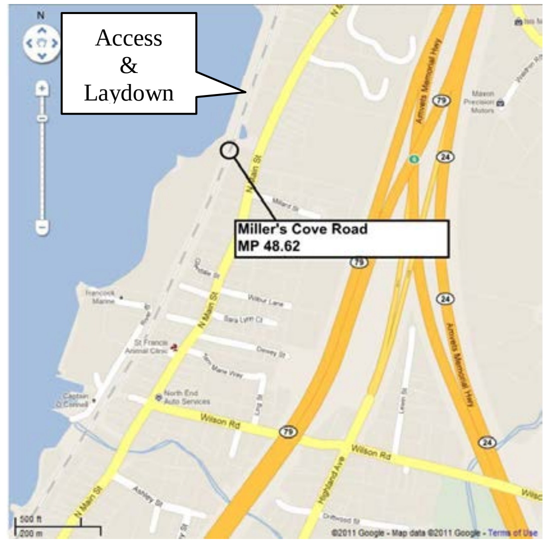
This overhead bridge can be constructed at any time. Construction staging would not significantly affect rail traffic as this is an overhead bridge.

2.3.5 2.3.5 Golf Club Road, Fall River

Access and lay-down for this site are available via the Golf Club Road at-grade crossing to the south.

This overhead bridge can be constructed at any time. Construction staging would not significantly affect rail traffic as this is an overhead bridge. This bridge must be reconstructed before the tracks below can be reconstructed.

2.3.6 Miller's Cove Road



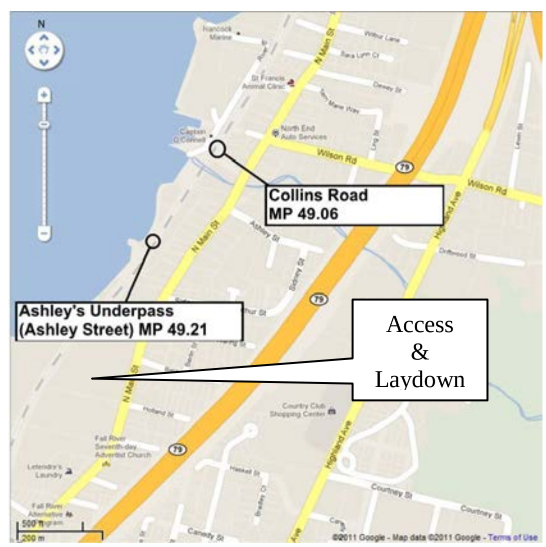
This site is accessible from abandoned Miller's Cove Road via 5856 North Main Street and 0.50 miles north from Golf Club Road. Lay-down and access for this site are also available 375 feet to the north from 3700-3820 North Main Street.

This bridge can be constructed at any time. Widening the proposed structure to accommodate rail service during construction will require material to be carried in over active track. The existing concrete bridge is rated below Cooper E80, but currently carries freight traffic. The existing bridge could carry limited construction related traffic.

2.3.7 Collins Road, Fall River

This site is accessible from Collins Road. Access and lay-down are available 0.50 miles southwest in the vicinity of 2684-2698 North Main Street.

This bridge can be constructed any time. The staging will include the construction of a new single track bridge adjacent to the existing bridge while maintaining rail service on the existing bridge. Rail service will then be shifted to the new bridge while the existing bridge is reconstructed. Material will have to be carried in over active track. The existing bridge is rated below Cooper E80, but currently carries freight traffic. The existing bridge could carry limited construction related traffic.



2.3.8 Ashley's Underpass (Ashley Street) , Fall River

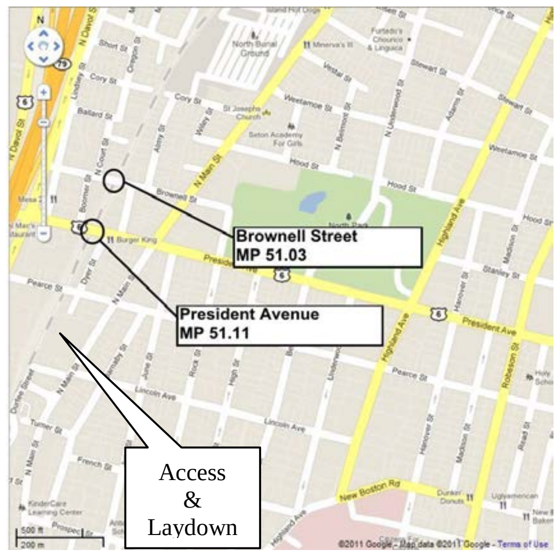
This site is accessible 280 feet north from Collins Road or 550 feet south at the Canedy's Underpass. The site is bounded and constrained by private property. This site is also accessible from Clark Street and River Street to the north. Some tree clearing may be necessary to gain access from River Street. Access and lay-down may be available 0.35 miles southwest in the vicinity of 2684-2698 North Main Street.

Ashley's Underpass can be constructed at any time. Widening the proposed structure to accommodate rail service during construction will require material to be carried in over active track. The existing bridge is rated below Cooper E80, but currently carries freight traffic and could carry limited construction related traffic.

2.3.9 Brownell Street, Fall River

This site is accessible from Brownell Street or 0.22 miles north via Railroad Avenue off of North Court Street. Lay-down space is available 0.25 miles south at 870 North Main street and is accessible from the Pearce Street and President's Avenue bridges.

This bridge can be constructed any time. The staging will include the construction of a new single track bridge adjacent to the existing bridge while maintaining rail service on the existing bridge. Rail service will then be shifted to the new bridge while the existing bridge is reconstructed. The existing bridge is rated below Cooper E80, but currently carries freight traffic and could carry limited construction related traffic.



2.3.10 President Avenue, Fall River

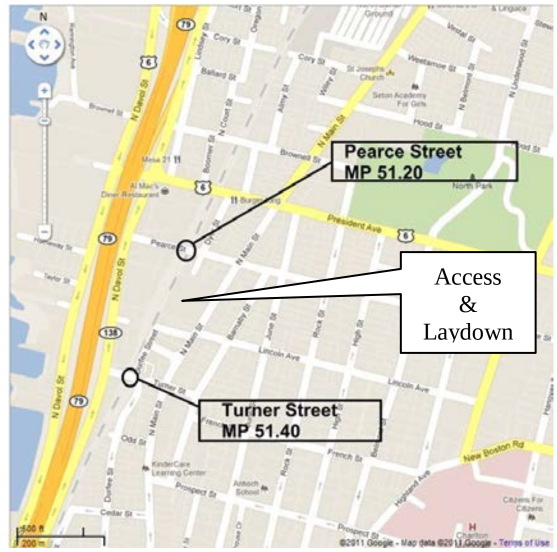
This site is accessible from President Avenue or 0.15 miles south at the parking lot behind 870 North Main Street via Pearce Street Bridge, which can also be used for construction laydown. Additional access is also available 0.14 miles north via Railroad Avenue from North Court Street as long as the Brownell Street bridge has been reconstructed.

This bridge can be constructed any time. The staging will include the construction of a new single track bridge adjacent to the existing bridge while maintaining rail service on the existing bridge. Rail service will then be shifted to the new bridge while the existing bridge is reconstructed. The existing bridge is rated below Cooper E80, but currently carries freight traffic and could carry limited construction related traffic.

2.3.11 Pearce Street, Fall River

This site is accessible from Pearce Street or from the south via Main Street, which has space for construction laydown.

The existing single track bridge over Pearce Street will be retained and will be used to maintain rail service while a second span is constructed adjacent to the existing span. The proposed structure will be a separate structure.



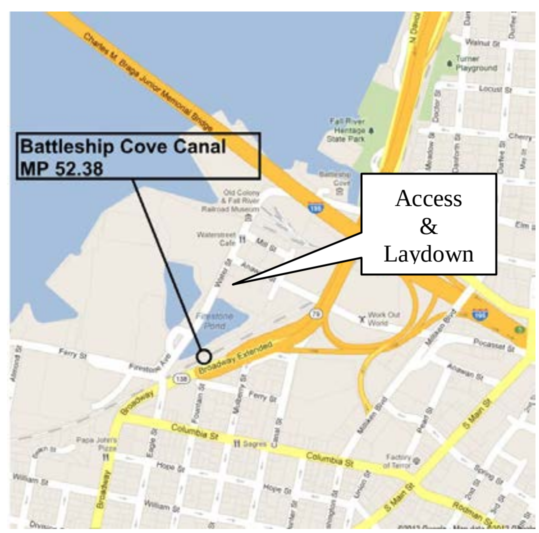
2.3.12 Turner Street, Fall River

This site is accessible from Turner Street or from an open lay-down area immediately to the south, or from the parking lot behind 870 North Main Street to the north.

The existing single track bridge over Turner Street will be retained and will be used to maintain rail service while a second span is constructed adjacent to the existing span. The proposed structure will be built as a separate structure.

2.3.13 Channel near Battleship Cove, Fall River

Access and lay-down for this bridge are available from the north at 118-184 Water Street



This page intentionally left blank.

Appendix 3.2-G

Methodology and Assumptions of Central Transportation Planning Staff Regional Travel Demand Modeling (2009)

METHODOLOGY AND ASSUMPTIONS OF CENTRAL TRANSPORTATION PLANNING STAFF REGIONAL TRAVEL DEMAND MODELING

South Coast Rail Project

Central Transportation Planning Staff

State Transportation Building
Ten Park Plaza, Suite 2150
Boston, Massachusetts 02116

August 28, 2009

INTRODUCTION

The regional travel model set of the Central Transportation Planning Staff (CTPS) is based on procedures that have evolved over many years at CTPS. It follows the traditional four-step travel-modeling process of trip generation, trip distribution, mode choice, and trip assignment and is implemented in the EMME software package. This modeling process is employed to estimate present and future daily transit ridership and daily highway traffic volumes, primarily on the basis of demography and the characteristics of the transportation network. The model set simulates travel on the entire eastern Massachusetts transit and highway systems. When the model set is estimating future travel, the inputs include forecasts of demography and projections of transit and highway improvements.

The CTPS regional travel model set was expanded and customized for the purposes of the South Coast Rail (SCR) project. However, the resulting model set is very similar to the standard regional travel model set used by CTPS. The methodologies, procedures, and theories underlying the trip generation, trip distribution, mode-choice, and trip assignment sub-models of the standard CTPS model set are used by the SCR model set. The two model sets also use the same software, and there are other similarities as well.

The most notable modification of the standard CTPS model to produce the SCR model was the addition of 191 transportation analysis zones and the associated expansion of the highway and transit networks. The SCR model set thus also includes transit services not included in the standard model set. For future years, the operating plan for proposed SCR build transit services was provided by Vanasse Hangen Brustlin, Inc. (included as an appendix to the present document). Where possible, the expanded zone system and networks included in the SCR model set were developed from a statewide travel model maintained by the Executive Office of Transportation and Public Works (EOT) (the EOT model itself was not used for the SCR forecasting primarily because it did not include a mode choice sub-model). Other differences between the standard CTPS model and the SCR model are found in some of the inputs needed for the various sub-models; in most cases, these differences stem from the addition of zones and the associated enlargement of the highway and transit networks.

This memorandum describes in detail the model set developed for the SCR project. The model set will generally be referred to as “the model,” for simplicity’s sake. The organization of this memorandum is:

Description of the Model

- Overview of the Four Steps
- Notable Features of the Model
- Model Structures and Inputs

The Four Steps of the Travel Demand Modeling Process

- Trip Generation
- Trip Distribution
- Mode Choice
- Trip Assignment

Air Quality Analysis

OVERVIEW OF THE FOUR STEPS

In the first step, trip generation, the total number of trips generated by residents of the 182 municipalities constituting the modeled area were calculated using demographic data. Similarly, the number of trips attracted to different types of land use, such as employment centers, schools, hospitals, shopping centers, etc., were estimated using land use data and trip generation rates obtained from travel surveys. This information on trips generated and attracted was produced at the level of disaggregated geographic areas known as transportation analysis zones (TAZs). All calculations were performed at the TAZ level.

In the second step, trip distribution, the model determined how the trips generated in each TAZ are distributed throughout the region. Trips were distributed based on transit and highway travel times between TAZs and on the relative attractiveness of each TAZ, which was also influenced by the number of jobs available and the size of schools, hospitals, shopping centers, etc.

Once the total number of trips between each pair of TAZs was determined, the mode choice step of the model (step three) allocated the total trips among the available modes of travel. The available modes of travel were walk, auto (single-occupant vehicle [SOV] and carpool), and transit (subdivided by access mode: walking to transit or driving to transit). To determine the proportion of trips to allocate to each mode, the model took into account the travel times, number of transfers required, parking availability, and costs associated with each option. Other variables, such as auto ownership and household size, were also included in the model.

After estimating the number of trips by mode for all possible TAZ combinations, in trip assignment (the fourth and final step) the model assigned trips to their respective specific routes. This was necessary because there is often more than one highway route or transit service between two TAZs.

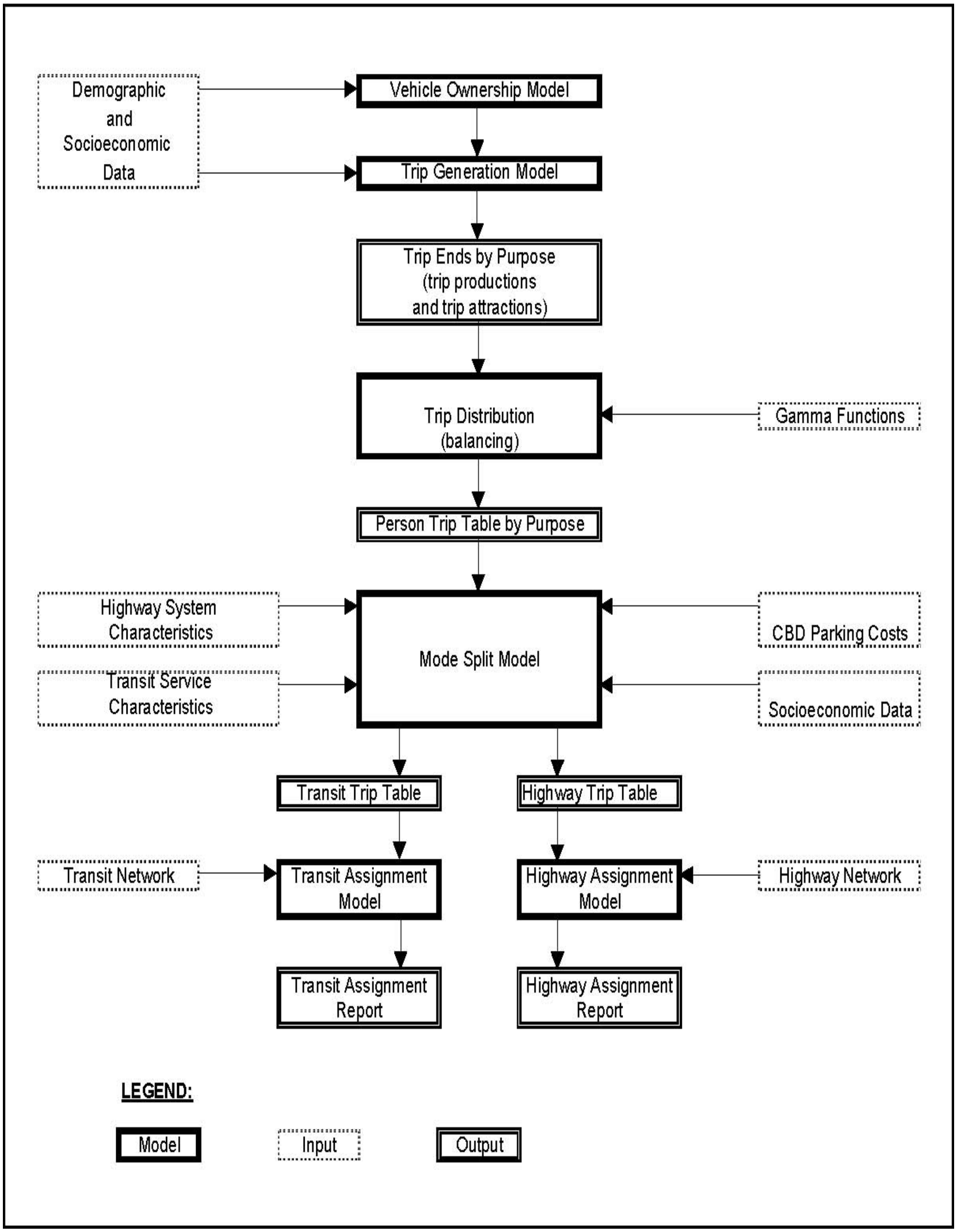
Various reports showing the transit ridership on different transit modes (including the specific ridership on each of the existing and proposed individual transit lines) and traffic volumes on the highway network were produced as needed. A schematic representation of the modeling process is shown in Figure 1.

NOTABLE FEATURES OF THE MODEL

The model developed for the South Coast Rail Study uses the best component models, networks, and input data available to CTPS at this time. Some of the notable features of the model are as follows:

- It incorporates both motorized and non-motorized trips.
- It simulates transit and highway travel during four time periods of a typical weekday.
- The trip generation, trip distribution, and mode choice components are well calibrated
- EMME software used in implementing the model is capable of performing multi-class, multi-path assignment that is superior to the traditional all-or-nothing assignment.

FIGURE 1
The Four-Step Demand Modeling Process



- The procedure that estimates air quality benefits is sophisticated and well integrated within the main model.

MODEL STRUCTURES AND INPUTS

Modeled Area

The model developed for the South Coast Rail project encompasses the 182 cities and towns in eastern Massachusetts indicated in Figure 2, which include the 101 municipalities of the Boston Region Metropolitan Planning Organization area and 81 additional communities. The figure also shows the boundaries of a core area and four concentric rings into which the modeled area is divided for model estimation and calibration purposes. These rings will be referred to in subsequent discussions.

Zone System

The modeled area for the South Coast Rail project is divided into 2,918 internal TAZs. There are also 117 external stations around the periphery of the modeled area that allow for travel between the modeled area and adjacent areas of Massachusetts, New Hampshire, and Rhode Island.

Transportation Networks

There are two types of network: transit and highway. Both are integrated in EMME. The highway network comprises express highways, principal and minor arterials, and local roadways. The transit network comprises commuter rail lines, rapid transit lines, and bus lines (MBTA and private carriers). The model contains service frequency (i.e., how often trains and buses run), routing, travel time, and fares for all lines.

- *Highway Network:* The regional highway network contains in excess of 100,000 links and 24,000 nodes. Like any highway network, it does not include some local and collector streets. Each link is coded with the appropriate free-flow speed, number of lanes, and lane capacity. Functional class is coded, as are various geographic flags useful for summarizing emissions. Another code is used to distinguish links open only to high-occupancy vehicles (HOVs) or closed to trucks.

- *Transit Network:* The transit network represents all MBTA bus and rail services in eastern Massachusetts, as well as private express buses, local transit agency bus routes, and Boston Harbor ferries. Included among the local transit agency bus routes are all of the Southeastern Regional Transit Authority (SRTA) bus routes. The private express bus services include existing DATTCO and Bloom buses between the South Coast study area and Boston. Most-likely travel paths are built through the network and afterwards skimmed, and the resulting impedances are input to the trip distribution and mode choice models. After mode choice, transit trip tables by time of day are assigned to the network travel paths.

Major Data Inputs

CTPS's travel model underwent a major revision in 1993, and several important data sources were used in that revision. Those and other major data items underlying the model are as follows:

- *Household Travel Survey:* In 1991, CTPS conducted a household travel survey. The survey took the form of an activity-based travel diary that was filled out for one weekday. Approximately 4,000 households, generating some 39,000 weekday trips, were represented in the final database. The data were used to estimate new models for trip generation, auto ownership, trip distribution, and mode choice.

- *External Cordon Survey:* Also in 1991, a survey of automobile travelers bound for the modeled area from adjacent areas was performed. Survey results were used in trip generation and distribution to update estimates of external trips.

- *Site-Level Employment Database:* Employment estimates for 1991 were taken from state-provided sources and a commercial vendor's database purchased by CTPS and were combined into a single, unified regional employment database that was updated to the base year 2000 based on employment data from the Department of Employment and Training and on extensive research by CTPS.

- *2000 U.S. Census:* Various census files were used in model estimation and calibration processes. In particular, Census Journey to Work information was incorporated into the model at several stages of model development for the South Coast Rail project.

- *Ground Counts:* Transit ridership and highway traffic volume data representing early 1990s conditions were amassed into a database and used to calibrate the travel sub-models. Updated counts and volumes have been used for model validation.

Analysis Year

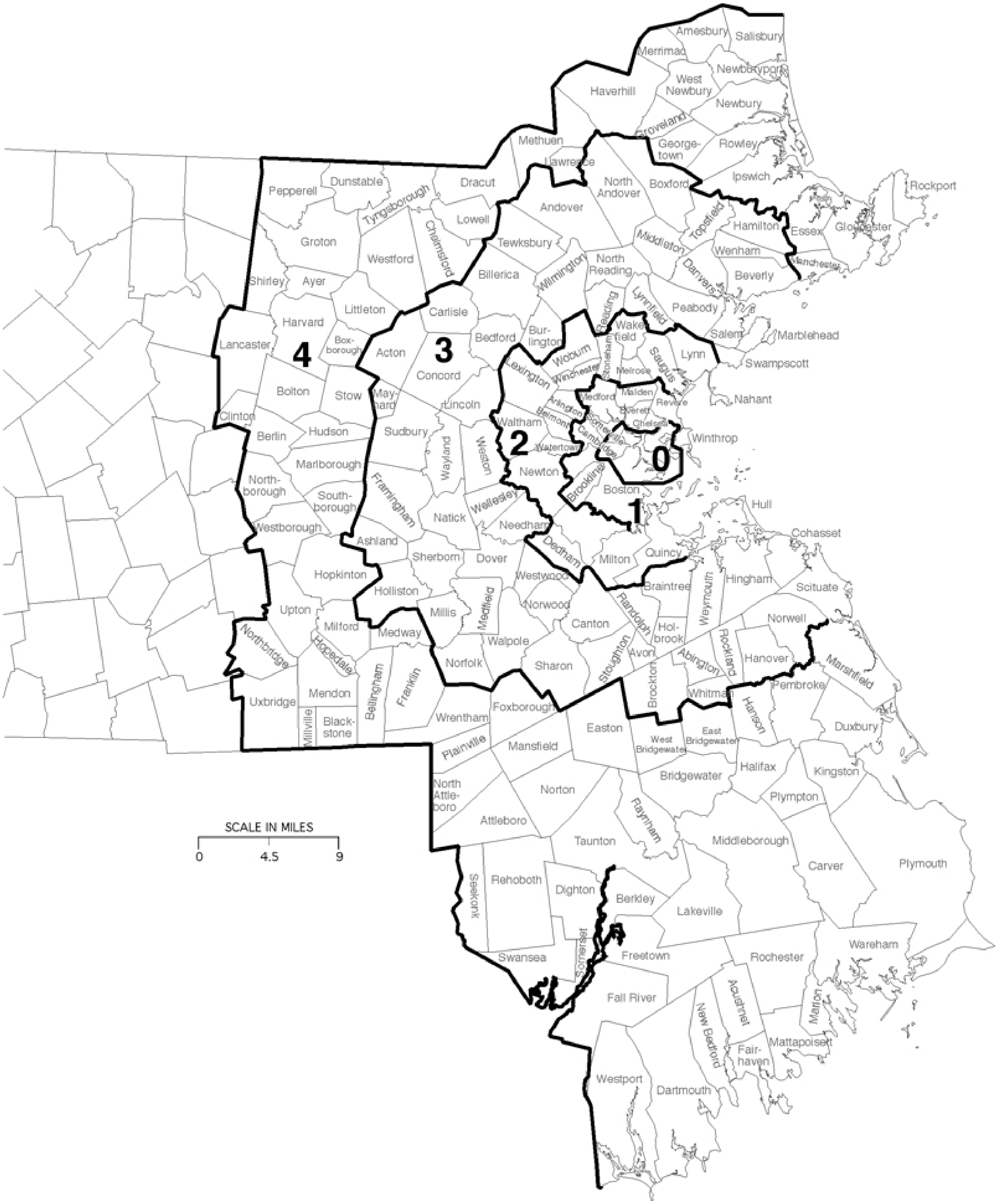
The base year is 2000 and the horizon year is 2030.

Time-of-Day Considerations

The mode choice and transit assignment steps of the modeling process are conducted on the basis of time periods. The four time periods modeled are an AM peak period, a midday period, a PM peak period, and a nighttime period. The trip generation model, however, is based on daily trips. The trip distribution model considers two time periods: peak and off-peak.

The highway and transit networks are built separately for each time period. Table 1 shows the time intervals associated with each time period. The highway vehicle trips and transit person trips created by the mode choice model are converted from production/attraction format to an origin/destination format, based upon the 1991 Household Travel Survey, prior to network assignment.

FIGURE 2
CTPS Modeled Area and Ring Boundaries



The factors used in dividing the highway person trips into different time periods were obtained from the 1991 Household Travel Survey. The final trip tables created for each time period reflect observed levels of congestion on the highway system. The results of the four assignments are summed to obtain daily (AWDT) results.

TABLE 1
Time Periods for Trip Assignment

Time Period	Highway Vehicle Trips	Transit Person Trips
AM Peak Period	6:00 AM – 9:00 AM	6:00 AM– 9:00 AM
Midday	9:00 AM– 3:00 PM	9:00 AM– 3:00 PM
PM Peak Period	3:00 PM– 6:00 PM	3:00 PM– 6:00 PM
Early Evening/Night	6:00 PM– 6:00 AM	6:00 PM– 6:00 AM

Population, Household, and Employment Forecasts

Households and employment by type are major inputs to the travel model process: they are the variables upon which trip generation estimates are based. The forecasts for the region were developed by combining household and employment predictions independently produced by the seven regional planning agencies/metropolitan planning organizations (RPAs/MPOs) in eastern Massachusetts: the Central Massachusetts Regional Planning Commission (CMRPC), Merrimack Valley Planning Commission (MVPC), Metropolitan Area Planning Council (MAPC), Montachusett Regional Planning Commission (MRPC), Northern Middlesex Council of Governments (NMCOG), Old Colony Planning Council (OCPC), and Southeastern Regional Planning and Economic Development District (SRPEDD).

Forecasts for the 101 cities and towns that make up the Boston Region MPO area were developed by MAPC based on its MetroFuture land use scenario. Forecasts for the 63 communities in the model belonging to RPAs/MPOs other than the Boston Region MPO were developed in a slightly different fashion. Each RPA/MPO independently maintains its own travel demand model, TAZ system, base-year estimates, and future-year forecasts. However, the Boston Region MPO's year 2000 base-year data have long been widely accepted as the most refined and detailed data set for the year 2000 for eastern Massachusetts, and significant faith has been invested in this data set in other studies, past and ongoing. Therefore, in the present modeling effort, future-year forecasts for these 63 communities pivoted off this vetted and reliable data but allowed for the growth projections envisioned by the individual RPA/MPO. This was done by adding the absolute changes in population and households predicted by the RPA/MPOs for the 63 communities to the Boston Region MPO's base-year estimates.

Employment forecasts were developed differently but also used the absolute change projected by the RPA/MPO and also pivoted off the Boston Region MPO's year 2000 data. The future-year Boston Region MPO distribution of employment by TAZ and by employment sector was applied to the RPA/MPO's absolute change at the community level. The resulting change was then added to the base-year Boston Region MPO employment data to produce the future-year forecasts. This hybrid approach took advantage of the accuracy of the Boston Region MPO's widely accepted demographic data sets while still capturing and respecting the growth expressed and projected by the individual RPAs/MPOs.

For the 18 SRPEDD communities not within the boundaries of the standard CTPS regional travel demand model set, SRPEDD land use forecasts and base year estimates of population, households, and employment were used. These SRPEDD forecasts were constrained by town-level control totals developed by the Executive Office of Transportation and Public Works (EOT). In some instances SRPEDD re-allocated demographics within one of the given 18 communities, but in all instances the EOT town-level control totals were maintained.

CALIBRATION OF THE MODEL

Calibration is the process in which model results or outputs are compared with observed data in order to assess the accuracy of a model. The model set used in the SCR study underwent an extensive calibration process. For the base year, the trip distribution, mode choice, and trip assignment sub-models of the SCR model set were run through an iterative feedback loop dozens of times to estimate the most accurate model parameters possible. This process constitutes a feedback loop in that certain outputs from each sub-model are in turn used as an input into another sub-model. For instance, highway and transit skims are an output of the assignment sub-model but are also an input into the trip distribution and mode choice sub-models. An accurate model can thus be obtained by iteratively running this chain of sub-models.

Within this iterative calibration process, particular attention was paid to the trip distribution sub-model calibration. The trip tables used and produced in trip distribution were scrutinized to ensure they were consistent with observed data. The observed data to which the trip distribution sub-model was calibrated were origin-destination and trip-length frequency data from the regional Household Travel Survey and census Journey to Work data sets. The parameters of the trip distribution sub-model were estimated so that the sub-model would distribute trips in a way that closely mimics the actual pattern of how trips are distributed in reality.

Mode choice sub-model parameters were also calibrated within the iterative feedback loop. Certain mode choice coefficients were estimated so that mode shares produced by the sub-model matched observed mode shares found in the area being represented. The observed data to which the mode choice sub-model was calibrated were from the Household Travel Survey.

Within the iterative calibration process, the final product—highway and transit volumes loaded onto the network—was also given close attention. The observed data to which the highway and transit assignment results were calibrated included observed highway counts, transit counts, and transit information from specific transit project studies.

Highway assignment results were compared to observed road counts along several screenlines and at several different locations on major area highways. The locations of these counts are given in Table 2.

TABLE 2
Screenline and Roadway Calibration Locations

North-South Screenline

Route 152	Attleboro
Oak Hill Avenue	
Route 118	
Tremont Street	Taunton
Route 44	
Route 138	
Berkley Street	
Route 24	
Route 79	
Pierce Avenue	Lakeville
Howland Road	
Route 140	
County Street	
Route 18	
Route 105	
South Street	Middleborough
Route 28	
Route 58	
I-495	
Wareham Street	Plymouth
Wareham Road	
Bourne Road	
Herring Run	
Route 3	
Route 3A	

External Western Screenline

Route 15	Seekonk
Route 152	
Route 114	
Route 44	
I-195	
Route 6	
Route 114	
Route 136	Swansea
Route 103	

External Southern Screenline

Route 138	Fall River
Route 24	
Route 81	
Route 177	Westport

External Cape Screenline

Route 28	Plymouth
Route 6	

Roadway Calibration Locations

Route 3 South	South Plymouth
	North Plymouth
	Marshfield
	Norwell
	North Weymouth

I-195	Swansea
	Dartmouth
	Marion
Route 24	Freetown
Route 140	New Bedford

Route 44	Seekonk
	Rehoboth
	West Taunton
	East Taunton
	West Middleborough

I-95	North of I-295
	North of Route 140
	South of Route 1
	South of Neponset Street

I-495	West of I-95
	East of Route 140
	West of Route 24
	East of Route 24
	Lakeville
	East of I-195

Transit assignment results were scrutinized at more than one level. Transit ridership was calibrated to systemwide ridership statistics. Particular attention was also paid to existing commuter rail stations in the study area on the Providence and Middleborough/Lakeville lines as well as to the existing private bus lines from Boston to New Bedford, Taunton, and Fall River. Modeling of ridership on the local bus service provided by the SRTA was calibrated to passenger counts conducted by CTPS.

THE FOUR STEPS OF THE TRAVEL DEMAND MODELING PROCESS

TRIP GENERATION

The first step in the travel forecasting process is performed by the model set's trip generation model. This model uses socioeconomic characteristics of the region's population and information about the region's transportation infrastructure, transportation services, and geography to predict the amounts of travel that will be produced by and attracted to each of the TAZs within the region.

The trip generation model is composed of seven parts:

- Base-year detailed inputs
- Future-year inputs
- Estimation of base-year detailed input requirements for future years
- Estimation of disaggregate socioeconomic characteristics
- Estimation of vehicle ownership
- Estimation of trip productions and attractions
- Balancing of trip productions and attractions

A description of each of these parts is presented below.

Base-Year Inputs

The base-year inputs required for the trip generation model are presented in Table 3.

Future-Year Inputs

The future-year inputs required for the trip generation model, some of which are the same as for the base year, are:

- Total TAZ households
- Total TAZ population
- Total TAZ group quarters population
- Total community population by age
- TAZ employment in basic industries
- TAZ retail trade employment

TABLE 3
Trip Generation Model: Base-Year Input Requirements

Data	Source	Geographic Level
Population	2000 U.S. census	TAZ (census block)
Group Quarters Population	2000 U.S. census	TAZ (census block)
Household Size, Income, Workers, Vehicles	2000 U.S. census	TAZ (census block)
Population Age	2000 U.S. census	City or town
Basic, Retail, Service Employment	2000 CTPS estimates	TAZ
Public K-12 Employment	2000 CTPS estimates	TAZ
Private K-12 Employment	2000 CTPS estimates	TAZ
College Employment	2000 CTPS estimates	TAZ
Resident Workers	2000 U.S. census	TAZ (census block group)
Dorm Population	2000 U.S. census	TAZ (census block)
Labor Participation Rate by Age Group	Bureau of the Census	Region
Land Area	CTPS regional database	TAZ
Geographical Ring	CTPS regional database	TAZ
Public Use Microdata Areas	CTPS regional database	Public Use Microdata Areas
External Trip Productions and Attractions	1991 External Survey, 2000 U.S. Census	External station
External Growth Factors	RPA and CTPS estimates	External station
External Growth Factors	RPA forecasts	External station
Transit Walk Access Factor	Transit network	TAZ
External Attraction and Production Terminal Times	Trip distribution model	External station

- TAZ employment in service industries
- Regional labor participation rates
- External trip production and attraction growth factors
- Transit walk-access factors

Estimation of Base-Year Input Requirements for Future Years

Various procedures are used to prepare the trip generation model input data for future years. The variables that are estimated in these procedures are listed below. A description of how future-year estimations for these variables are made follows the list.

- Households by household size
- Households by income quartile
- Resident workers
- Households by workers per household
- School employment (K-12 and college)
- Dorm population
- External person trips
- Attraction and production terminal times

Household Size

The change in TAZ average household size is implied in the base-year inputs and future-year forecasts (total population minus group quarters population divided by total households). The distribution of future-year households by household size is estimated by the following procedure.

First, the future-year households are distributed among the household size categories in the same proportions as in the base year. It is then assumed that all households capable of making the implied change (households of two or more for household size reductions; all households for household size increases) will have the same probability of changing in size by one person. This probability of changing is set equal to the extent needed to match the forecasted change in household size, and the resulting distribution of households by household size is used for the future-year scenario.

As an example, suppose that in the base year the numbers of 1-person, 2-person, 3-person, 4-person, 5-person, and 6+-person households are, respectively, 100, 200, 50, 25, 10, and 5, with a total household population of 835. This represents an average household size of 2.141. If there were 780 future-year households, they would initially be distributed as 200, 400, 100, 50, 20, and 10 1-person, 2-person, 3-person, 4-person, 5-person, and 6+-person households, respectively.

However, if the future-year average household size were 2.000, then the households with 2 or more persons would have a 19 percent [(2.141 - 2) * 780/580] probability of dropping in size by one. The resulting distribution would thus be estimated as follows:

276 1-person households [200 + (.19 * 400)],
343 2-person households [400 – (.19 * 400) + (.19 * 100)],

90.5 3-person households [100 – (.19 * 100) + (.19 * 50)],
44.3 4-person households [50 – (.19 * 50) + (.19 * 20)],
and 26.2 5+-person households [20 – (.19*20) + 10].

In the case of TAZs with no households in the base year, the proportional distribution of households by household size at the community level is used for the base year in these calculations.

Household Income

The future-year distribution of households by household income quartile is estimated by assuming that the proportional distribution of households by income quartile remains constant within each TAZ. In the case of TAZs with no households in the base year, the proportional distribution of households by household income at the community level is used for the base year.

Resident Workers per Household

The change in the number of resident workers at the community level is obtained by combining base-year and future-year estimates of over-age-15 population and labor force participation by age cohort. Dividing the base-year and future-year estimates of community-level resident workers by the base-year and future-year numbers of households in the community, respectively, produces estimates of the base-year and future-year average workers per household. All of the TAZs within each community are assumed to have the proportional change in workers per household implied by these base-year and future-year community-level estimates. Multiplying the resultant estimate of resident workers per household by the forecasted number of households yields the forecasted number of resident workers by TAZ.

This estimation method (see Table 4) may be described via the following example. Assume that a community's 2000 and 2010 populations are distributed by age as follows: 1,000 and 1,200, 10,000 and 11,000, 2,000 and 2,500, and 500 and 600, respectively, in the 16-24, 25-54, 55-64, and 65+ age ranges. If the applicable labor force participation rates are applied, the estimated numbers of community resident workers become 10,317 and 11,785 for 2000 and 2010, respectively. If the estimated numbers of community households were 5,500 and 6,000 for 2000 and 2010, respectively, the community average workers per household for 2000 and 2010 would be 1.88 and 1.96, respectively. As 1.96 is 4.3% greater than 1.88, all of the TAZs in that community would be assumed to have a 4.3% increase in workers per household between 2000 and 2010.

TABLE 4
Labor Force Participation Rates

Age	2000	2010	2025	2030
16-24	65.9%	63.9%	63.4%	63.4%
25-54	84.1%	84.7%	85.1%	85.0%
55-64	59.2%	64.4%	63.6%	63.7%
65+	12.8%	15.2%	15.6%	14.5%

Household Workers

The future-year number of households per TAZ within each category of number of workers per household is estimated by using workers-per-household distribution curves developed by CTPS from the 1990 U.S. census. These curves, summarized in Table 5 below, indicate a default percentage distribution of households for the base-year and future-year TAZ estimates of average workers per household. The proportional changes in the default number of households within each category of workers per household implied by this comparison are applied to the actual base-year TAZ distribution of households to obtain the distribution of households by workers per household to be used for the future scenario. The average number of workers per household at the community level is used for the base year in TAZs with no households in the base year.

For example, if the average number of workers per household changes from 1.7 to 1.8, the default distribution of households among the categories 0-worker, 1-worker, 2-worker, and 3+-worker would change from 7%, 32%, 45%, and 16% to 5%, 29%, 47%, and 19% households, respectively. If the actual base-year distribution of households among those categories is 8%, 31%, 44%, and 17%, the changes in the default distributions indicates a future-year distribution of households of 6%, 28%, 46%, and 20% 0-worker, 1-worker, 2-worker, and 3+-worker households, respectively.

School Employment

- K-12

  The level of employment in schools providing education up to the 12th grade is assumed to be proportional to the number of community residents of ages 5-19.

- College

  The level of employment at all colleges and technical schools within the region is assumed to be proportional to the number of regional residents of ages 20-24.

TABLE 5
Workers per Household Diversion Curves

Avg. Workers	Households by Number of Workers				
per HH	**0**	**1**	**2**	**3+**	**Total**
<=.45	58%	40%	2%	0%	100%
.45 - .55	52%	46%	2%	0%	100%
.55 - .65	47%	46%	6%	1%	100%
.65 - .75	43%	46%	10%	1%	100%
.75 - .85	38%	46%	13%	3%	100%
.85 - .95	34%	46%	16%	4%	100%
.95 - 1.05	30%	45%	20%	5%	100%
1.05 - 1.65	65% - (35% * Avg)	60% - (16% * Avg)	(36% * Avg) - 15%	(15% * Avg) - 10%	100%
1.65 - 1.75	7%	32%	45%	16%	100%
1.75 - 1.85	5%	29%	47%	19%	100%
1.85 - 1.95	4%	26%	48%	22%	100%
1.95 - 2.05	3%	22%	48%	27%	100%
2.05 - 2.15	2%	18%	49%	31%	100%
2.15 - 2.25	1%	14%	49%	36%	100%
2.25 - 2.35	1%	10%	49%	40%	100%
2.35 - 2.45	1%	4%	50%	45%	100%
2.45 - 2.55	1%	4%	50%	45%	100%
> 2.55	0%	5%	50%	45%	100%

Dorm Population

The dorm population within a TAZ is assumed to be proportional to the total group quarters population within a TAZ.

External Person Trips

Base-year external person trips are factored up by forecasts of vehicle volumes at the external stations based upon the MassHighway statewide travel forecasting model.

Attraction and Production Terminal Times

The attraction and production terminal times are estimated through the application of a model developed at CTPS. This model estimates terminal times as a function of household and employment density. An alternative estimate of the production and attraction terminal times for each TAZ is based on household and employment density ranges. For regional modeling, the larger of the two estimates is assigned to a TAZ. Several TAZs with regionally unique characteristics (locations of major generators such as airports or large colleges) were assigned terminal times in the base year different from the terminal time model estimates. In these cases, the model is used to estimate changes in terminal times.

Estimation of Detailed Socioeconomic Characteristics

A three-way distribution of the households within each TAZ by household size, income, and workers is required in order to estimate the distribution of households by vehicle ownership levels. While this is available from the U.S. census at the subregional level, such distributions at the TAZ level are estimated through iterative proportional fitting techniques. Using the appropriate subregional matrix as a seed, the cell values are adjusted through 10 iterations to match row and column totals to the estimated TAZ-level totals in order to produce an estimated three-way distribution of households for each TAZ.

Estimation of Vehicle Ownership

Base-year households are distributed by vehicle ownership based on data from the 2000 U.S. census. The distribution of future-scenario households by vehicle ownership is estimated through the application of a set of models developed by CTPS.

The CTPS vehicle ownership model was estimated as a set of four multinomial logit disaggregate choice models, one for each of four income categories, in which the decision maker was the household unit and the set of alternatives was the ownership, by the household, of 0, 1, 2, or 3-or-more vehicles. In this model, households were segmented into four income categories because of the belief that income is the most significant variable in vehicle-ownership choice. Other variables included in the model included household size, workers per household, household density, employment density, household location, and transit walk-access factors. The data set used to estimate this model contained 3,504 observations. Once estimated, the model was validated to observed vehicle ownership data. The models, one for each household income quartile, are presented in Table 6.

Estimation of Trip Productions and Attractions

The number of trip productions and trip attractions within a TAZ are estimated through the application of a set of models developed at CTPS. These models estimate the number of trip productions and attractions as a function of household size, workers per household, vehicles per household, income, household location, households, basic employment, retail employment, college employment, school employment, and service employment. The home-based trip production models are presented in Table 7, while the non-home-based trip production and trip attraction models are presented in Table 8.

TABLE 6
Summary of Auto Ownership Model

	Constant	HH Size	Workers per HH	HHs per Acre	Employ per Acre	High-Density	Low-Density	Ring01	Transit Walk-Accessibility
Low-Income Household Model									
0 Vehicles	-0.0474	-0.1692	-0.1312	0.0239		0.7136			
1 Vehicle									
2 Vehicles	-3.139	0.6182	0.4414	-0.0424					
3+ Vehicles	-5.074	0.7968	0.6927	-0.2232					
Medium-Low-Income Household Model									
0 Vehicles	-1.573	-0.1874	-0.3417	0.05		0.5716		0.5392	
1 Vehicle									
2 Vehicles	-1.745	0.5202	0.4279	-0.0627	-0.0334				-0.0056
3+ Vehicles	-5.101	0.7371	1.112	-0.0627	-0.0693				
Medium-High-Income Household Model									
0 Vehicles	-2.63			0.0459		0.7704			
1 Vehicle									
2 Vehicles	-1.223	0.6609	0.2377	-0.0391			0.4026	-0.5962	-0.0054
3+ Vehicles	-4.572	0.7899	1.289	-0.0779				-1.223	-0.0073
High-Income Household Model									
0 Vehicles	-2.793			0.0349					
1 Vehicle									
2 Vehicles	0.5049	0.3475	0.2688	-0.06	-0.0154				-0.0074
3+ Vehicles	-3.807	0.5717	1.628	-0.136	-0.0468				-0.0077

High-Density = 1 if HH/acre > 6 or Employ/acre > 7

Low-Density = 1 if HH/acre < 0.5 and Employ/acre< 0.7

Ring01 = 1 if TAZ is in Ring 0 or Ring 1

Transit Walk-Accessibility = Portion of TAZ within walk-access distance of transit service

TABLE 7
Home-Based Trip Production Rate Models

Home-Based Work Trip Production Rates

Workers per HH	HH Size	Vehicles per HH 0	1	2+
1	*1*	0.94	1.17	1.11
1	*2*	1.01	1.23	1.18
1	*3*	1.15	1.38	1.32
1	*4*	1.48	1.7	1.65
1	*5+*	1.56	1.78	1.71
2	*2*	2.47	2.66	2.47
2	*3*	2.64	2.81	2.61
2	*4*	2.68	2.84	2.64
2	*5+*	2.83	2.99	2.79
3+	*3*	2.72	3.14	3.68
3+	*4*	2.75	4.02	4.55
3+	*5+*	2.88	4.15	4.68

Home-Based Personal Business Trip Production Rates

Workers per HH	HH Size	Vehicles per HH 0	1	2	3+
0	*1*	1.19	1.95	2.11	2.87
0	*2*	2.91	3.32	3.5	4.24
0	*3*	3.29	3.7	3.88	4.62
0	*4*	4.16	4.58	4.73	5.49
0	*5+*	1.56	4.71	4.87	5.63
1	*1*	0.5	1.01	1.2	1.27
1	*2*	1.85	2.35	2.55	2.62
1	*3*	2.25	2.82	3.04	3.11
1	*4*	2.52	2.91	3.08	3.13
1	*5+*	2.55	2.93	3.15	3.23
2	*2*	1.04	1.5	1.63	2.12
2	*3*	1.4	1.87	1.99	2.48
2	*4*	2.37	2.83	2.95	3.45
2	*5+*	2.44	2.91	3.03	3.52
3+	*3*	1.43	1.96	2.24	2.49
3+	*4*	2	2.75	3.14	3.49
3+	*5+*	2.34	3.2	3.67	4.08

HB Work-Related Trip Production Rates

HH Size	Workers per HH 1	2	3+
1	0.12		
2	0.1	0.18	
3	0.1	0.2	0.28
4	0.18	0.23	0.35
5+	0.21	0.29	0.41

TABLE 8
Trip Attraction Rates and Non-Home-Based Trip Production Rates

	Households	Basic Employment	Retail Employment	Service Employment		
				College	K-12	Other
			Production Rate Models			
Non-Home-Based Work	0.07	0.47	1.78	1.86	0.93	0.93
Non-Home-Based Other	0.57		1.74	2.49	0.28	0.28
			Attraction Rate Models			
Home-Based Work		1.42	1.64	1.23	1.23	1.23
Home-Based Work-Related		0.06	0.35	0.27	0.08	0.08
Home-Based Personal Business	1.25		4.17			
Home-Based Social/Recreational	1.28		1.34	1.13		
Home-Based School				3.3	9.25	
Home-Based Pick-Up/Drop-Off	0.13	0.04	0.04	0.04	4.25	0.04
Non-Home-Based Work	0.11	0.32	2.36	1.85	0.79	0.79
Non-Home-Based Other	0.59		1.91	2.01	0.22	0.22

Balancing of Trip Productions and Attractions

Connecting a trip production with a trip attraction of the same trip purpose forms a trip. As a result, the number of productions and attractions for each trip purpose must be equal. In order to achieve this, the trip productions and attractions are balanced.

For most trip purposes, the number of regional attractions is the least reliable estimate. As a result, the normal balancing procedure is to set the total number of regional attractions equal to the difference between the grand total of productions and the total number of external attractions.

However, future regional employment (the determinant of home-based work [HBW] trip regional attractions) is forecasted, so the numbers of future external HBW productions and attractions are less reliable. The model assumes that the number of external HBW productions will satisfy the forecasted employment within the region, so the HBW external productions are set equal to the difference between the total HBW attractions and the regional HBW productions.

The following changes were thus made as part of the balancing procedure:

- Regional HBW attractions are adjusted to match the base-year ratio of total regional HBW attractions to total regional HBW productions with the ratio from the 2000 U.S. census Journey to Work data (1.077).
- External HBW attractions are adjusted to match the base-year ratio of total external HBW attractions to total regional HBW productions with the ratio from the 2000 U.S. census Journey to Work data (.0442).

- External HBW productions are set equal to the difference between the grand total of HBW attractions and the regional HBW productions.

TRIP DISTRIBUTION

The trip distribution model performs the second step in the travel forecasting process. It combines the estimated trip productions and trip attractions prepared by the trip generation model into: an interregional vehicle trip table and an intraregional pick-up/drop-off vehicle trip table to be used as input into the highway assignment model; and intraregional person trip tables to be used as inputs into the mode choice model.

The trip distribution model is made up of three components: a set of internal-external trip distribution models and two sets of intraregional trip distribution models (one for peak travel periods and the other for non-peak travel periods). An overview of the model is presented below.

Internal-External Trip Distribution

Internal-external trip distribution refers to a process in which all internal and external average weekday (AWD) trip ends (trip productions and attractions) are combined into trips using AWD highway impedances, but only the trips with one end in an internal zone and the other end in an external zone are retained. The resultant internal-external trip tables are used as inputs to the highway assignment model. The remaining trip ends are used as inputs to the intra-regional trip distribution model.

The model includes a separate process for each of seven trip purposes: home-based work, home-based personal business, home-based social/recreational, home-based school, home-based pick-up/drop-off, non-home-based work, and non-home-based other. The process undertaken for each purpose consists of the following five steps:

- Convert highway travel times from time period origin-destination format to AWD production-attraction format
- Apply gamma functions to create an initial trip table estimate
- Initiate a three-dimensional balancing process, adjusting the initial trip table to match trip productions, trip attractions, and a trip-length frequency distribution
- Create internal/external vehicular trip tables
- Create intra-regional person trip table productions and attractions

Each of these steps is described below.

Conversion of Highway Travel Times

Estimates of highway travel times are prepared using the highway assignment model on an origin-destination basis for each time period. In order to use these with the trip productions and attractions from the trip generation model, the highway travel time estimates produced by the highway assignment are adjusted for each trip purpose by temporal directional factors for each trip purpose from the latest regional household travel survey.

Applying Gamma Functions

Gamma functions are estimated using base-year highway travel time estimates and survey trip tables to produce an initial estimate of a model-based trip table. These functions provide an estimate of the number of trips within each cell of the trip table based upon linear regression fitting.

The resultant trip table is referred to as the seed trip table. A trip length frequency distribution is imposed upon the seed trip table by dividing the table into classes of zone pairs. The zone pairs within each class connect a common pair of districts (forming an "interchange") and fall within a designated range of trip lengths (or "class"). A separate gamma function is used for each interchange. The number of interchanges and classes used for each trip purpose is presented in Table 9.

TABLE 9
Number of Interchanges and Classes Used for Each Trip Purpose

	Internal-External		Intra-Regional Peak		Intra-Regional Non-Peak	
Trip Purpose	**Interchanges**	**Classes**	**Interchanges**	**Classes**	**Interchanges**	**Classes**
HBW	36	250	36	250	36	250
HBPB	36	250	34	228	36	246
HBSR	35	247	33	227	36	244
HBSC	24	229	16	218	16	224
HBPD	25	241	4	49	4	51
NHBW	36	250	36	250	36	249
NHBO	25	244	33	226	36	249

Three-Dimensional Balancing

The seed trip table is adjusted through an iterative process in order to match the trip table subtotals as closely as possible to the estimated trip productions, trip attractions, and trip length frequency distribution. Each iteration consists of adjusting all the cells within a dimension (row, column, or class) by the factor needed to match the sum of that dimension to the estimated subtotal in that dimension (productions for row, attractions for column, trip length range trips for class) and then performing the same calculations for the other two dimensions. Since there is more confidence in trip production estimates than in the trip attraction or trip length frequency estimates, the iterative process ends with an exact matching of the trip table production totals to the input trip productions for each purpose.

Internal-External Trip Tables

The portions of the resultant trip table connecting external stations and regional TAZs are saved and adjusted for use in the highway assignment model. Vehicle occupancy data from the latest external travel survey are used to convert the person trips to vehicle trips. Temporal and directional factors from the latest external travel survey are then used to convert the trips from one matrix of AWD trips from production zone to attraction zone to four matrices of time period (AM peak, midday, PM peak, and night) trips from origin zone to destination zone.

Intra-Regional Productions and Attractions

The portions of the resultant trip table connecting regional TAZs are summed by TAZ of production and TAZ of attraction for use in the Intra-Regional Trip Distribution Model. Data from the latest household travel survey are used to split these trip production and trip attraction files into peak-period and non-peak-period files.

Intra-Regional Trip Distribution (Peak and Non-Peak)

Intra-regional trip distribution refers to a process in which all peak-period and non-peak-period intra-regional trip ends are separately combined into trips using composite impedances from the mode choice model. The resultant peak and non-peak intra-regional trip tables are used as inputs to the mode choice model and highway assignment model (home-based pick-up/drop-off trips).

The model includes a separate process for each of seven trip purposes: home-based work, home-based personal business, home-based social/recreational, home-based school, home-based pick-up/drop-off, non-home-based work, and non-home-based other. Similar to the Internal-External Trip Distribution Model, the process undertaken for each purpose consists of the following three steps:

- Convert composite impedance estimates from time period to peak and non-peak format
- Apply gamma functions to create an initial trip table estimate
- Initiate a three-dimensional balancing process, adjusting the initial trip table to match trip productions, trip attractions, and a trip-length frequency distribution

The results of these steps are then processed to final form in the following two steps:

- Create pick-up/drop-off vehicular trip tables
- Create intra-regional person trip tables

The five steps are described below.

Conversion of Composite Impedances

Estimates of purpose-specific composite impedances are prepared using the mode choice model for origin-destination TAZ pairs for each time period. In order to use these with the intra-regional trip productions and attractions from the Internal-External Trip Distribution Model, the composite impedance estimates produced by the mode choice model are adjusted for production -attraction TAZ pairs for each trip purpose by temporal factors for each trip purpose from the latest regional household travel survey.

Applying Gamma Functions

Gamma functions are estimated using base-year composite impedance estimates and trip tables to produce an initial estimate of a model-based trip table. These functions provide an estimate of the number of trips within each cell of the trip table based upon linear regression fitting.

The resultant trip table is referred to as the seed trip table. A trip length frequency distribution is imposed upon the seed trip table by dividing the table into classes of zone pairs. The zone pairs within each class connect a common pair of districts (forming an “interchange”) and fall within a designated range of trip lengths (or “class”). A separate gamma function is used for each interchange. The number of interchanges and classes used for each trip purpose is presented in Table 9 (above).

Three-Dimensional Balancing

The seed trip table is adjusted through an iterative process to match the trip table subtotals as closely as possible to the estimated trip productions, trip attractions, and composite impedance range frequency distribution. This process is the same as the one used in the Internal-External Trip Distribution Model. Since there is more confidence in trip production estimates than in the trip attraction or trip length frequency estimates, the iterative process ends with an exact matching of the trip table production totals to the input trip productions for each purpose.

Pick-Up/Drop-Off Vehicular Trip Tables

Since they are all assumed to be vehicular trips, the resultant trip tables for the home-based pick-up/drop-off purpose are converted directly to vehicular trip tables so that they can be used in the highway assignment model. Vehicle occupancy data from the latest household travel survey are used to convert the person trips to vehicle trips. Temporal and directional factors from the latest household travel survey are then used to convert the trips from matrices of peak period and non-peak period trips from production zone to attraction zone to matrices of time period (AM peak, midday, PM peak, and night) trips from origin zone to destination zone.

Intra-Regional Person Trip Tables

The resultant trip tables for the other purposes are then prepared. Data from the latest household travel survey are used to split these peak-period and non-peak period files into AM peak, midday, PM peak, and night person trip tables. These trip tables are then used as inputs to the mode choice model.

MODE CHOICE

Overview

Mode choice is the third step in travel demand forecasting and in CTPS's regional travel demand model. It is the process in which the trips from distribution are split between the various available modes of the transportation network.

CTPS developed multinomial logit mode choice models by trip purpose using 1991 Household Travel Survey data, travel impedances obtained from highway and transit networks, 1990 and 2000 U.S. census data, and a variety of other data sources. The mode choice models estimate modal splits for four trip purposes: 1) home-based work and work-related (HBW); 2) home-based other (HBO), which includes home-based shopping, personal business, social, recreation, and other miscellaneous purposes; 3) home-based school (HBSC); and 4) non-home-based (NHB). These models have been calibrated and validated. The mode choice models are applied, by purpose, to the distributed trip tables that result from the trip distribution model.

The mode choice models split the trip purposes among six modes: 1) walk-access transit, 2) drive-access transit, 3) single-occupancy vehicles, 4) high-occupancy vehicles with two persons, 5) high-occupancy vehicles with three or more persons (for the HBW trip purpose only), and 6) a pure walk mode. Specific sub-mode selection (i.e., local bus, express bus, light rail, commuter rail, etc.) occurs during the transit assignment process.

The mode choice models estimate mode splits for intra-regional trips only (trips contained within the model boundaries). They estimate mode shares for both interzonal trips (from one zone to another zone) and intra-zonal trips (from and to the same zone); however, intra-zonal trips are only split between the walk and auto modes. Transit splits are not estimated for intra-zonal trips.

Variables

The following are brief descriptions of the variables the mode choice models use to estimate mode splits:

Nest coefficient: Represents the degree of interactivity between the modes within the nest and other modes or nests. The value ranges between 0 and 1, with 1 indicating that transfers to and from other modes are as likely as transfers to and from modes within a nest. A value of 0 indicates there would be no transfer between the nest modes and other modes.

In-vehicle travel time (IVTT): Represents time spent in the modal vehicle during a given trip. For the shared-ride modes, in-vehicle and out-of-vehicle time are functions of drive-alone time. This variable is often considered in conjunction with value of time (VOT).

Out-of-vehicle time: Includes all walk, boarding, and wait time.

Drive-access time: Represents driving time between a trip end and a transit station parking lot.

Terminal time: Represents the time it takes to access a vehicle at the production end of a trip and the time it takes to get from a vehicle to a destination at the attraction end of a trip.

Fare: Represents the transit fare, in dollars, a transit rider will pay to use the system.

Auto cost: Represents auto operating and toll costs. Also included is one-half of any applicable parking costs (because such costs are calculated on the basis of a one-way trip.) Also, for shared-ride modes, total costs are divided by the appropriate auto occupancy.

Household size: Represents the number of persons per household. This estimate is obtained from the Trip Generation sub-model.

Vehicles/person: Represents the total number of vehicles per person in a household. Vehicles are forecasted for 2030 using the vehicle availability model described earlier.

Population density: Represents total population per acre.

Percent transit origins/destinations: Represents the AM peak period transit share of work trip ends within a TAZ, as computed by the home-based work mode-choice model.

The Four Trip Purposes

Home-Based Work Model

Home-based work (HBW) is the only trip purpose for which the mode choice models distinguish between two-person carpools (HOV2) and three-or-more-person carpools (HOV3+). The model specifications are shown in Table 10. Formerly, travel in HOV lanes was restricted to HOV3+ vehicles during peak hours. For the past several years, however, any two-person vehicle may also use these facilities.

A transit nest is incorporated into the model on the basis that the decision to take transit over the other modes is made before selection of a particular transit mode. The transit coefficients are generic for both walk access (WAT) and drive access (DAT) and include coefficients for in-vehicle, initial wait, transfer wait, and total walk time. Drive-access time and production terminal times are included in drive-access transit as one parameter.

The WAT fare includes the transit fare in dollars. For DAT, costs include the transit fare and half of any parking cost. Population density by traffic zone, in people per acre, is included in walk-access transit, and it is positively correlated: the greater the density, the more likely a traveler is to choose this mode. The zones with high population densities also have more transit stops. Vehicles per worker is a socioeconomic input unique to this trip purpose for DAT. It is also positively correlated, since a higher vehicle-per-worker ratio increases the likelihood of taking a vehicle to a park-and-ride lot.

The auto times and costs are generic for the three auto modes. For HOV2, the auto cost is divided by 2 and for HOV3+ it is divided by 3.66 to reflect splitting the cost between the vehicle

TABLE 10
Home-Based Work Mode Choice Model Specifications

		Impedance Variables									Socioeconomic Variables		
	Nest Coeff	IVTT	Terminal Time	Walk Time	Initial Wait	Transfer Wait	Auto Access	Boarding Time	Fare ($)	Auto Cost ($)	Population. Density	Vehicles/ Worker	HHld Size
Drive Alone													
Top Level	1	-0.05466	-0.292							-0.32			
Application Level		-0.05466	-0.292							-0.32			
Ratio to IVTT/VOT ($/hr)		1	5.34211							$ 10.25			
HOV2													
Top Level	1	-0.05466	-0.292							-0.32			0.07322
Application Level		-0.05466	-0.292							-0.32			0.07322
Ratio to IVTT/VOT ($/hr)		1	5.34211							$ 10.25			-1.33955
HOV3+													
Top Level	1	-0.05466	-0.292							-0.32			0.2168
Application Level		-0.05466	-0.292							-0.32			0.2168
Ratio to IVTT/VOT ($/hr)		1	5.34211							$ 10.25			-3.96634
Walk													
Top Level	1			-0.1007									
Application Level				-0.1007									
Ratio to IVTT/VOT ($/hr)													
Walk-Access Transit													
Top Level	0.6791	-0.05466		-0.1007	-0.11292	-0.11292		-0.05466	-0.32		0.01889		
Application Level		-0.08049		-0.14828	-0.16628	-0.16628		-0.08049	-0.47121		0.02781		
Ratio to IVTT/VOT ($/hr)		1		1.8423	2.06593	2.06593		1	$ 10.25		-0.34551		
Drive-Access Transit													
Top Level	0.6791	-0.05466	-0.292	-0.1007	-0.11292	-0.11292	-0.13665	-0.05466	-0.32	-0.32		0.2897	
Application Level		-0.08049	-0.42998	-0.14828	-0.16628	-0.16628	-0.20122	-0.08049	-0.47121	-0.47121		0.4266	
Ratio to IVTT/VOT ($/hr)		1	5.34211	1.8423	2.06593	2.06593	2.5	1	$ 10.25	$ 10.25		-5.30011	

occupants. Household size is included as a positively correlated variable for the shared-ride modes and has a somewhat greater impact for HOV3+ than HOV2.

Home-Based Other Model

The home-based other (HBO) mode choice model combines the home-based shopping and home-based recreational trip tables output from the trip distribution process into a single HBO trip table that is split. The model specifications are shown in Table 11. The model is similar to the HBW mode choice model, except for the following three differences. First, since there is only one shared-ride mode, HOV2+, household size is only a parameter for this one mode. Second, the vehicles per person in a household is used, as opposed to vehicles per worker. Finally, a distance dummy equal to one if the trip distance is less than a mile, zero otherwise, is added to the walk mode. This reflects the fact that people taking short trips for this purpose are more likely to walk than choose another mode.

Non-Home-Based Model

The non-home-based (NHB) model splits work trips and non-work trips. The model specifications are shown in Table 12. There is a work dummy variable in the two auto modes which is equal to one if the trip is a non-home-based work trip and zero otherwise. The coefficient is positive for SOV and negative for HOV. The percent of trips attracted to the origin and destination zones that is SOV is a variable in the drive alone mode. The percentage is taken from the results of the HBW mode choice model and is positively correlated. Finally, the distance dummy in the walk mode is equal to one if the distance is less than a mile. It has a positive coefficient.

Home-Based School Model

The home-based school (HBSC) model was re-estimated and restructured in 2004 to allow for compatibility of the HBSC purpose with the Federal Transit Administration's Summit program. The previous HBSC model had one nest—all motorized modes. The revised HBSC model has two nests—transit and highway. The revised HBSC model specifications are shown in Table 13.

Pre-Assignment Procedure

The completion of the runs for the 16 mode choice applications (4 trip purposes by 4 time periods) results in the creation of 68 person trip tables. To prepare for subsequent highway and transit assignments, the trip tables must be converted from production-attraction to origin-destination format (except for NHB trips, where they are the same). This is done using factors from the 1991 Household Travel Survey.

For the highway assignment, it is necessary to convert person trips to vehicle trips by applying vehicle occupancy factors for HOV modes. These occupancy factors vary by trip purpose, and in the case of HBW trips a higher occupancy factor is applied to HOV3+ trips. Because the HBW HOV mode includes 2-person and 3-person-plus HOVs, the occupancy factor for the

TABLE 11
Home-Based Other Mode Choice Model Specifications

		Impedance Variables									Socioeconomic Variables			
	Nest Coeff	IVTT	Terminal Time	Walk Time	Initial Wait	Transfer Wait	Auto Access	Boarding Time	Fare ($)	Auto Cost ($)	Population. Density	Vehicles/ Worker	HHld Size	Distance Dummy
Drive Alone														
Top Level	1	-0.01965	-0.2308							-0.22378				
Application Level		-0.01965	-0.2308							-0.22378				
Ratio to IVTT/VOT ($/hr)		1	11.7463							$ 5.27				
HOV2+														
Top Level	1	-0.01965	-0.2308							-0.22378			0.1976	
Application Level		-0.01965	-0.2308							-0.22378			0.1976	
Ratio to IVTT/VOT ($/hr)		1	11.7463							$ 5.27			-10.0566	
Walk														
Top Level	1			-0.05895										0.9005
Application Level				-0.05895										0.9005
Ratio to IVTT/VOT ($/hr)														-15.2757
Walk-Access Transit														
Top Level	0.3722	-0.01965		-0.05895	-0.05895	-0.05895		-0.01965	-0.22378		0.00883			
Application Level		-0.05279		-0.15838	-0.15838	-0.15838		-0.05279	-0.60123		0.02373			
Ratio to IVTT/VOT ($/hr)		1		3.0002	3.0002	3.0002		1	$ 5.27		-0.44951			
Drive-Access Transit														
Top Level	0.3722	-0.01965	-0.2308	-0.05895	-0.05895	-0.05895	-0.04912	-0.01965	-0.22378	-0.22378		0.71239		
Application Level		-0.05279	-0.6201	-0.15838	-0.15838	-0.15838	-0.13198	-0.05279	-0.60123	-0.60123		1.914		
Ratio to IVTT/VOT ($/hr)		1	11.7463	3.0002	3.0002	3.0002	2.5	1	$ 5.27	$ 5.27		-36.2564		

TABLE 12
Non-Home-Based Work Mode Choice Model Specifications

		Impedance Variables									Socioeconomic Variables		
	Nest Coefficient	IVTT	Terminal Time	Walk Time	Initial Wait	Transfer Wait	Auto Access	Boarding Time	Fare ($)	Auto Cost ($)	Work Dummy	Distance Dummy	Percent SOV
Drive Alone													
Top Level	1	-0.03022	-0.3197							-0.1817	0.1926		0.00885
Application Level		-0.03022	-0.3197							-0.1817	0.1926		0.00885
Ratio to IVTT/VOT ($/hr)		1	10.5791							$ 9.98	-6.37326		-0.29295
HOV2+													
Top Level	1	-0.03022	-0.3197							-0.1817	-0.7627		
Application Level		-0.03022	-0.3197							-0.1817	-0.7627		
Ratio to IVTT/VOT ($/hr)		1	10.5791							$ 9.98	25.2383		
Walk													
Top Level	1			-0.07525								0.493	
Application Level				-0.07525								0.493	
Ratio to IVTT/VOT ($/hr)												-6.5515	
Walk-Access Transit													
Top Level	1	-0.03022		-0.07525	-0.08333	-0.08333		-0.03022	-0.1817				
Application Level		-0.03022		-0.07525	-0.08333	-0.08333		-0.03022	-0.1817				
Ratio to IVTT/VOT ($/hr)		1		2.49007	2.75745	2.75745		1	$ 9.98				
Drive-Access Transit													
Top Level	1	-0.03022	-0.3197	-0.07525	-0.08333	-0.08333	-0.07555	-0.03022	-0.1817	-0.1817			
Application Level		-0.03022	-0.3197	-0.07525	-0.08333	-0.08333	-0.07555	-0.03022	-0.1817	-0.1817			
Ratio to IVTT/VOT ($/hr)		1	10.5791	2.49007	2.75745	2.75745	2.5	1	$ 9.98	$ 9.98			

TABLE 13
Home-Based School Mode Choice Model Specifications

	Nest Coefficient	Impedance Variables: IVTT	Terminal Time	Walk Time	Wait Time	Drive Access Time	Fare ($)	Auto Cost ($)	Population Density
Drive Alone									
Top Level	0.5559	-0.0305	-0.0904					-0.1803	
Application Level		-0.0548	-0.1626					-0.3244	
Ratio to IVTT ($/hr)		1.0000	2.9672					$10.14	
HOV2+									
Top Level	0.5559	-0.0305	-0.0904					-0.1803	
Application Level		-0.0548	-0.1626					-0.3244	
Ratio to IVTT ($/hr)		1.0000	2.9672					$10.14	
Walk									
Top Level	1			-0.0791					
Application Level				-0.0791					
Ratio to IVTT ($/hr)									
Walk-Access Transit									
Top Level	0.5559	-0.0305		-0.0791	-0.0791		-0.1803		0.0150
Application Level		-0.0548		-0.1423	-0.1423		-0.3244		0.0270
Ratio to IVTT ($/hr)		1.0000		2.5967	2.5967		$10.14		-0.4927
Drive-Access Transit									
Top Level	0.5559	-0.0305	-0.0904	-0.0791	-0.0791	-0.0762	-0.1803	-0.1803	0.0150
Application Level		-0.0548	-0.1626	-0.1423	-0.1423	-0.1371	-0.3244	-0.3244	0.0270
Ratio to IVTT ($/hr)		1.0000	2.9672	2.5967	2.5967	2.5018	$10.14	$10.14	-0.4927

HOV2 mode is exactly 2 persons per vehicle. The exact values for 2-person-plus and 3-person-plus HOVs are the following:

Home-based work trips	HOV3+ = 3.373
Home-based other trips	HOV2+ = 2.404
Home-based school trips	HOV2+ = 2.788
Non-home-based trips	HOV2+ = 2.385

In addition to the manipulation of the output matrices from mode choice, it is necessary to bring in vehicle trip tables produced outside of the mode choice process. These vehicle trip tables are:

- Truck – The truck trip tables that have been used up to the present are based on survey data.
- External Through – This matrix consists of trips that pass through the study area without stopping and hence are exogenous to the travel model. The trips were estimated from the 1991 external travel survey, 2000 census Journey to Work data, and traffic counts.
- Taxi – The taxi vehicle trip table was originally developed from a 1993 survey and has since been revised several times based upon a factoring process. However, there has been no update of travel pattern data to create a true updated trip table.
- Logan Airport SOV and HOV – This trip table is developed from a separate modeling procedure, which was developed based on a Massport survey.

- Drive-Access-Transit Auto Access – DAT trips are determined through the station choice model, which is a part of the mode choice process. Each DAT trip requires a vehicle access trip.
- Internal–External SOV and HOV – The internal–external trip tables are generated through the trip distribution process.
- Pick-Up/Drop-Off SOV and HOV – The pick-up/drop-off (PUDO) tables are those trips in which a person is dropped off at his or her destination (not an intermediate park-and-ride lot) by the driver. They are produced in the trip generation process along with other productions and attractions, then put through trip distribution.

TRIP ASSIGNMENT

Trip assignment is the fourth step in the travel demand forecasting process and in CTPS's regional travel demand model. Trip assignment is the process by which each trip in the trip tables resulting from the mode choice model is assigned to a specific submode (for example, bus or rapid transit) and a specific route. The CTPS model uses one or the other of two distinct assignment procedures, depending upon whether the trip has been split to a transit or highway mode.

Highway Assignment Routine

The highway assignment implemented in EMME is an equilibrium assignment. The fundamental assumption underlying such an assignment procedure is that each user of the highway network will choose the route that he or she perceives to be the best. The assignment is an aggregate assignment in that traffic volumes on any given link are an aggregate number, as opposed to being associated with a specific trip. There are several inputs used by the EMME equilibrium assignment procedure. The key inputs are the highway demand matrices, the volume delay function, and the highway network:

- Highway demand matrices

  The demand matrices that the highway assignment procedure uses as an input are the demand matrices that result from mode choice and distribution. These are origin-destination matrices of single-occupancy vehicles, trucks, taxis, internal-external trips, through trips, and high-occupancy vehicles.

- Volume-delay function

  The function used in the highway assignment procedure is a volume-delay function, which, when applied in the context of a highway assignment, changes the speeds users of the network experience based upon the volumes on the network. The volume-delay function employed in the CTPS regional model is a variation on the so-called Bureau of Public Roads (BPR) function. Developed by its now defunct namesake, the BPR function is a widely used and validated volume-delay function that is parabolic in shape and takes the form:

  $$\text{Congested Speed} = (\text{Free-Flow Speed})/(1 + [\text{Volume/Capacity}]^4)$$

The CTPS regional model is segmented by time periods. For each time period, the BPR function is altered to reflect the number of hours in that period.

- Highway network

  The highway network is an abstract digital representation of the real highway network in eastern Massachusetts. For future-year scenarios, the highway network depicts roadway links that are planned in addition to the existing highway network. The base-year highway network is a depiction of the eastern Massachusetts highway network as it existed in the year 2000. The highway network in the base and future years includes information about number of lanes, free-flow speeds, and capacity (in vehicles per lane per hour). Freeways typically have a free-flow speed of 60 miles per hour, are three lanes, and have a capacity of 1,950 vehicles per lane per hour. Smaller arterials typically have a free-flow speed of 30 to 45 miles per hour, are coded as having one or two lanes, and have a capacity of 900 to 1,000 vehicles per lane per hour. Such parameters are consistent with widely accepted traffic engineering principles and the Transportation Research Board's *Highway Capacity Manual.*

The highway assignment procedure performs a multi-class generalized cost equilibrium auto assignment. The multi-class assignment runs an assignment for the demand matrices of three modes, SOV, HOV, and trucks, from the vehicle trip tables for each class, which are assigned by time period. Tolls affect the assignment and are stored on the network.

The highway assignment procedure is iterative in that the assignment is calculated repeatedly, in order to mathematically optimize assignment results. The CTPS regional model is set to run to 30 iterations before stopping. The assignment also considers another stopping criterion known as the relative gap. The relative gap is an estimate of the difference between the current assignment and a perfect equilibrium assignment, in which all paths used for a given origin-destination pair would have exactly the same time. The default relative gap is .5%, but CTPS employs .01% so that a more accurate assignment will result.

Another stopping criteria is the normalized gap (or trip time differential), which is the difference between the mean trip time of the current assignment and the mean minimal trip time. The mean trip time is the average trip time on the paths used in the previous iteration; the mean minimal trip time is the average trip time computed using the shortest paths of the current iteration. Again, a minimum level is selected, .01 minutes, in order for the designated number of iterations to be carried out. Note that the relative gap always decreases from one iteration to the next, whereas the trip time difference does not necessarily have this property. In a perfect equilibrium assignment, both the relative gap and the normalized gap are zero.

Transit Assignment Routine

The transit assignment used in EMME is a multi-path assignment based on the calculation of optimal transit strategies for system users. A transit strategy is roughly analogous to a path in highway assignment. The major difference between a strategy and a path is that a strategy may employ different modes, which in real terms is the equivalent of a transfer between modes. The transit assignment allows for users of the transit system switching within the transit network between various available transit modes in order to reach their destination. In basic terms, the transit assignment algorithm examines at each node in the transit network, and for each transit network user, what transit service is optimal, given the origin and destination node pairs. This algorithm is repeated until the transit user arrives at the final destination. Like the highway assignment procedure, the transit assignment procedure utilizes several key inputs to estimate a transit assignment. Three of the key inputs are the transit demand matrices, the transit functions and the transit network:

- Transit demand matrices

  The transit demand matrices are just that, matrices of trips that have been split into the transit mode because the utility of their trip suggests transit may be an attractive mode choice for their particular origin destination pair.

- Functions

  The function used in the transit assignment procedure depicts the relative levels of attractiveness between the variety of sub-modes available in the eastern Massachusetts transit network. Costs are translated to time assuming a value of time of $12 per hour (using 1991 dollars) and doubling the out-of-vehicle time before adding it to in-vehicle time.

- Transit network

  The transit network is an abstract digital representation of the real transit network in eastern Massachusetts. For future-year scenarios, the transit network depicts transit links that are planned in addition to the existing transit network. The base-year transit network is a depiction of the eastern Massachusetts transit network as it existed in the year 2000. The transit network includes every commuter rail line, rapid transit line, bus route, and ferry route in eastern Massachusetts. The bus routes run on the highway network, and their run times are influenced by roadway traffic congestion. Among other things, the transit network in the base and future years includes information about vehicle headways, wait times, transit run times, and fares. The assignment algorithm takes into consideration all of these elements in calculating a transit assignment.

  Additionally, the transit network represents and accounts for park-and-ride facilities. Park-and-ride nodes provide connections between the highway and transit networks via a walk link. As a result, drive-access transit trips use both the highway and the transit networks.

  The transit network is augmented by a data input known in EMME as a line. This input contains many of the features unique to a given sub-mode such as run time, headways, and station stopping details. There is a different line file for each time period represented by the CTPS model.

  Another major element of the transit network is so-called walk links. Some walk links serve as transfers between sub-modes. Other walk links serve as transfers between modes (see park-and-ride information above) but the vast majority of walk links are so-called walk-access links. All walk links have a hard-coded speed of 3 miles per hour.

Walk-access estimation

Walk-access links are an abstract representation of all of the walking routes transit users utilize in eastern Massachusetts to access the transit system. In other words, they are an aggregate abstraction of the sidewalks, roadways, backyards, driveways, and shortcuts people use to walk to the transit system.

The walk-access estimation process is an automated process that involves three steps. The first step builds paths and distances on a walk network roadway geographic information system (GIS) coverage that is created from the most recent statewide digital line graph (DLG) coverage of the roadway network. The roadways that are suitable for walking within the study area are then cut from that coverage. The path building and distance skimming between transit stops and zones is calculated on this coverage. The latest set of transit stops from the EMME databank are then imported into a GIS environment. The distances between stops and zones are then calculated from this coverage. Up to two walk links are created between each TAZ and the stations and stops on each transit line, with no links over one mile. Transfer links are created to connect all stations and stops within a quarter-mile walk.

Fare Coding

In addition to time, one of the key modeled metrics is cost. In the case of transit, user costs are captured by fares that are coded onto the network. The CTPS regional model allows for testing of a variety of complicated fare schemes. A significant portion of the fare information in the model is coded onto walk links. This makes intuitive sense because transit users often pay for access to the system at the end of their walk to access the system—at the turnstile, entrance to the bus, gate to the ferry, etc. The fares coded onto walk links are called boarding fares. The other kind of fare coding allowed for is zonal-based fare information. This type of fare structure is implemented with long-haul services such as commuter rail and express buses and is imposed on segments of the transit path.

Path-Building Conventions

As mentioned earlier, the transit assignment implemented in EMME is a multi-path assignment based on the computation of optimal strategies. An optimal strategy is one that minimizes the total expected perceived travel time for a transit system user. In order to reflect the fact that time is perceived by the transit system user differently depending on the portion of the trip being considered, weighting factors have been developed and applied to different portions of the transit trip. For example, transit riders perceive time spent waiting for a transit vehicle as more onerous than time spent traveling in a vehicle. The values shown in Table 14 are currently being used for the purposes of developing transit skims for mode choice and for building optimal strategies in transit assignment.

The values in the table apply both to walk-access transit and drive-access transit and to all sub-modes. They are all relative to in-vehicle time. Although these values theoretically correspond to marginal rates of substitution implicit in mode choice model coefficients, their final values are also based on what is needed to find reasonable paths through the network within the pathbuilder.

TABLE 14
Current Pathbuilding Parameter Values

Parameter	Value
Initial wait time factor	2
Transfer wait time factor	2
Transfer penalty	2.45
Bus boarding penalty	7
Walk-access time factor	2
Walk speed	3.0 mph
Fare factor	1.0

AIR QUALITY ANALYSIS

The mobile-source emissions of alternative transportation scenarios can be forecasted and analyzed using the CTPS travel demand forecasting model in conjunction with U.S. Environmental Protection Agency (EPA) emissions rates that are developed by the EPA Mobile software. The model estimates traffic volumes, average highway speeds, vehicle miles traveled, and vehicle hours traveled. The EPA Mobile software develops emission factors by pollutant and speed for different years based on, among other things, assumptions about fleet fuel efficiency. Using these tools, reasonable estimates of emissions from mobile sources can be developed for various years and network conditions.

The procedure described above is used to estimate emissions from cars and trucks of carbon monoxide (CO), nitrogen oxides (NOx), volatile organic compounds (VOCs), carbon dioxide (CO_2), and particulate matter. Emissions from commuter rail diesel locomotives and MBTA buses and some automobile emissions associated with park-and-ride lots are estimated off model.

In the South Coast Rail analysis, as in most transit studies, the emission factors and roadway networks remained constant between the no-build and build alternatives, and the observed emission changes are due to mode shifts from auto to transit that result in lower VMT and possibly lower congested speeds on the roadway network.

APPENDIX

Operating Plans for Proposed Build Alternatives

South Coast Rail Project

Vanasse Hangen Brustlin, Inc.

South Coast Rail Operation for Each Alternative (DRAFT)

List of Alternatives

Alt. 1A	Attleborough - Diesel	Rail
Alt. 1B	Attleborough - Electric	Rail
Alt. 4A - Local	Stoughton - Diesel - Local	Rail
Alt. 4B - Local	Stoughton - Electric - Local	Rail
Alt. 4C - Local	Stoughton - Diesel - Local - Whittenton Route	Rail
Alt. 4D - Local	Stoughton - Electric - Local - Whittenton Route	Rail
Alt. 5	Rapid Bus Alternative	Bus
Alt. 6	No Build (TSM) Alternative	Bus

Park-N-Ride Facilities in No Build Alternative

P-N-R Facility	Capacity	Fee*
Route 106 near Route 24 (West Bridgewater)	180**	Free
Route 24 Exit 12 Silver City Galleria (Taunton)	211	Free
Oak Street Bloom/GATRA Terminal (Tunton)	160	Free
I-495 Exit 8/Greyhound Track (Raynham)	150	Free
Mt. Pleasant Street (New Bedford)	201	Free
72 Sycamore Street (fairhaven)	28	Free

* Fee for commuter parking

** Route 106/Route 24 Park-N-Ride currently has a parking capacity of 140 spaces, but there is additional 40 spaces being planned to be added in the near future, and is included in the No Build Alternative.

Headway on Branches

Alternative	AM and PM Peaks	MD and NT
Alt. 1A, 1B - Attleborough	40 min	2 hr
Alt. 4A-Local, 4B-Local, 4C-Local, 4D-Local - Stoughton	40 min	2 hr
Alt. 5 - Rapid Bus Alternative	15 min	1 hr
Alt. 6 - No Build (TSM) Alternative	30 min	Varies*

* Headways vary for the off-peak hours.

Travel Time*

Alternative	Stations***	Northbound** AM	Northbound** PM	Southbound** AM	Southbound** PM
Alt. 1A (Fall River - S.Station)	Battleship Cove (Off Peak Only) - FR Depot - Freetown - E. Taunton - Taunton Depot - Barrowsville - Mansfield _ Rt. 128 - Ruggle St. (OB Only) - Back Bay - S. Station	82 min	n/a	n/a	86 min
Alt. 1B (Fall River - S.Station)		72 min	n/a	n/a	74 min
Alt. 1A (New Bedford - S.Station)	Whale's Tooth - King's Hwy - E. Taunton - Taunton Depot - Barrowsville - Mansfield - Rt. 128 - Ruggles St. (OB Only) - Back Bay - S. Station	84 min	n/a	n/a	87 min
Alt. 1B (New Bedford - S.Station)		75 min	n/a	n/a	76 min
Alt. 4A - Local (Fall River - S.Station)	Battleship Cove (Off-Peak Only) - FR Depot - Freetown - E. Taunton - Taunton - Raynham - Easton Village - N. Easton - Stoughton - Canton Ctr - Canton Junction - Rt. 128 - Hyde Park - Ruggle St.(OB Only) - Back Bay - S. Station	83 min	n/a	n/a	85 min
Alt. 4B - Local (Fall River - S.Station)		73 min	n/a	n/a	76 min
Alt. 4C - Local (Fall River - S.Station)	Battleship Cove (Off-Peak Only)- FR Depot - Freetown - E. Taunton - Taunton Depot - Raynham - Easton Village - N. Easton - Stoughton - Canton Ctr - Canton Junction - Rt. 128 - Hyde Park - Ruggle St. (OB Only) - Back Bay - S. Station	94 min	n/a	n/a	96 min
Alt. 4D - Local (Fall River - S.Station)		85 min	n/a	n/a	87 min
Alt. 4A - Local (New Bedford - S.Station)	Whale's Tooth - King's Hwy - E. Taunton - Taunton - Raynham - Easton Village - N. Easton - Stoughton - Canton Ctr - Canton Junction - Rt. 128 - Hyde Park - Ruggle St. (OB Only) - Back Bay - S. Station	85 min	n/a	n/a	86 min
Alt. 4B - Local (New Bedford - S.Station)		76 min	n/a	n/a	78 min
Alt. 4C - Local (New Bedford - S.Station)	Whale's Tooth - King's Hwy - E. Taunton - Taunton Depot - Raynham - Easton Village - N. Easton - Stoughton - Canton Ctr - Canton Junction - Rt. 128 - Hyde Park - Ruggle St. (OB Only) - Back Bay - S. Station	96 min	n/a	n/a	97 min
Alt. 4D - Local (New Bedford - S.Station)		87 min	n/a	n/a	89 min
Alt. 5 - Rapid Bus (FallRiver - S. Station)****	Fall River Depot - Freetown - South Station	91 min	81 min	81 min	88 min
Alt. 5 - Rapid Bus (New Bedford - S, Station)	Whale's Tooth - King's Highway - South Station	103 min	93 min	93 min	99 min
Alt. 5 - Rapid Bus (Taunton Depot - S. Station)	Taunton Depot - South Station	68 min	62 min	62 min	65 min
Alt. 5 - Rapid Bus (Taunton Galleria _ S. Station)	Galleria Station - South Station	66 min	60 min	60 min	63 min
Alt. 6 - No Build Alternative (FallRiver - S. Station)*****	Fall River Depot _ South Station	84 min	n/a	n/a	66 min
Alt. 6 - No Build Alternative (New Bedford - S. Station)	Fair Haven - Downtown New Bedford - Mt. Pleasant - Taunton - South Station	105 min	95 min	100 min	100 min
Alt. 6 - No Build Alternative (Taunton - S. Station)	GATRA/Bloom Terminal - Dog Track - 106@24 - Boston	86 min	75 min	70 min	75 min

* Travel times for the rail Alternatives were obtained from SYSTRA and include dwell time.

** Travel times for the rail Alternatives were provided for inbound and outbound without peak designation. Given data were assumed to be the peak direction. However, travel time for the off-peak direction should not differ significantly as long as the train makes the same stops.

*** The list of stations include all stations that will be operational in the build scenarios.

**** For the Rapid Bus Alternative, travel times have been refined to more accurately mimic the operations based on the CTPS' data, Google Map, and Transportation Studies.

***** For the No Build Alternative, travel times were estimated based on the measure time through bus rides for the peak period/peak direction, the others were estimated based on the current schedules.)

****** The build alternatives include station parking constraints at Taunton Station (200 spaces) and Barrowsville Station (264 spaces).

Parking Supply at Rail Stations in Build Conditions

2009 DEIR Planning	
Station	Parking Spaces Provided
N. Easton	519
Easton Village	0
Raynham Park	455
Taunton	200
East Taunton (N)	473
Freetown	183
FR Depot	510
Battelship Cove	0
King's Hwy	0
Whale's Tooth	694
Barrowsville	264
Taunton Depot	737
Stoughton Station	468
Canton Center	0
Mansfield	0
Sharon	0
Total	4503

Fare

Alternatives 1 (Attleboro)

From \ To	Battleship	FR Depot	Freetown	State Pier	Whale's Tooth	King's Hwy	E. Taunton	Taunton Depot	Barrowsville	Mansfield	Sharon	Canton Jct	Route 128	Hyde Park	Boston
Battleship	-	$1.61	$1.61	-			$1.84	$1.84	$1.84	$2.34	$2.82	$3.05	$3.30	$3.59	$4.50
Fall River Depot	$1.61		$1.61	-			$1.84	$1.84	$1.84	$2.34	$2.82	$3.05	$3.30	$3.59	$4.50
Freetown	$1.61	$1.61	-	-			$1.84	$1.84	$1.84	$2.34	$2.82	$3.05	$3.30	$3.59	$4.50
State Pier	-	-	-	-	$1.61	$1.61	$1.84	$1.84	$1.84	$2.34	$2.82	$3.05	$3.30	$3.59	$4.50
Whale's Tooth	-	-	-	$1.61	-	$1.61	$1.84	$1.84	$1.84	$2.34	$2.82	$3.05	$3.30	$3.59	$4.50
King's Hwy	-	-	-	$1.61	$1.61		$1.84	$1.84	$1.84	$2.34	$2.82	$3.05	$3.30	$3.59	$4.50
E. Taunton	$1.84	$1.84	$1.84	$1.84	$1.84	$1.84		-	$1.61	$1.84	$2.57	$2.82	$3.05	$3.30	$4.34
Taunton Depot	$1.84	$1.84	$1.84	$1.84	$1.84	$1.84		-	$1.61	$1.84	$2.57	$2.82	$3.05	$3.30	$4.34
Barrowsville	$1.84	$1.84	$1.84	$1.84	$1.84	$1.84	$1.61	$1.61		$1.84	$2.57	$2.82	$3.05	$3.30	$4.34
Mansfield	$2.34	$2.34	$2.34	$2.34	$2.34	$2.34	$1.84	$1.84	$1.84		$2.34	$2.57	$2.82	$3.05	$4.11
Sharon	$2.82	$2.82	$2.82	$2.82	$2.82	$2.82	$2.57	$2.57	$2.57	$2.34		$1.84	$2.34	$2.57	$3.39
Canton Jct	$3.05	$3.05	$3.05	$3.05	$3.05	$3.05	$2.82	$2.82	$2.82	$2.57	$1.84		$1.84	$2.34	$2.91
Route 128	$3.30	$3.30	$3.30	$3.30	$3.30	$3.30	$3.05	$3.05	$3.05	$2.82	$2.34	$1.84		$1.84	$2.68
Hyde Park	$3.59	$3.59	$3.59	$3.59	$3.59	$3.59	$3.30	$3.30	$3.30	$3.05	$2.57	$2.34	$1.84		$2.68
Boston	$4.50	$4.50	$4.50	$4.50	$4.50	$4.50	$4.34	$4.34	$4.34	$4.11	$3.39	$2.91	$2.68	$2.68	

Alternative 4 (Stoughton)

	Battleship	FR Depot	Freetown	State Pier	Whale's Tooth	King's Hwy	E. Taunton	Taunton	Whittenton	Raynham	Easton	Stoughton	Canton Ctr	Canton Jct	Route 128	Hyde Park	Boston
Battleship	-	$1.61	$1.61	-			$1.84	$1.84	$1.84	$2.34	$2.57	$2.82	$3.05	$3.05	$3.30	$3.59	$4.50
FR Depot	$1.61		$1.61	-			$1.84	$1.84	$1.84	$2.34	$2.57	$2.82	$3.05	$3.05	$3.30	$3.59	$4.50
Freetown	$1.61	$1.61	-	-			$1.84	$1.84	$1.84	$2.34	$2.57	$2.82	$3.05	$3.05	$3.30	$3.59	$4.50
State Pier	-	-	-	-	$1.61	$1.61	$1.84	$1.84	$1.84	$2.34	$2.57	$2.82	$3.05	$3.05	$3.30	$3.59	$4.50
Whale's Tooth	-	-	-	$1.61	-	$1.61	$1.84	$1.84	$1.84	$2.34	$2.57	$2.82	$3.05	$3.05	$3.30	$3.59	$4.50
King's Hwy	-	-	-	$1.61	$1.61		$1.84	$1.84	$1.84	$2.34	$2.57	$2.82	$3.05	$3.05	$3.30	$3.59	$4.50
E. Taunton	$1.84	$1.84	$1.84	$1.84	$1.84	$1.84		$1.61	$1.61	$1.84	$2.34	$2.57	$2.82	$2.82	$3.05	$3.30	$4.34
Taunton	$1.84	$1.84	$1.84	$1.84	$1.84	$1.84	$1.61		$1.61	$1.84	$2.34	$2.57	$2.82	$2.82	$3.05	$3.30	$4.34
Whittenton	$1.84	$1.84	$1.84	$1.84	$1.84	$1.84	$1.61	$1.61		$1.84	$2.34	$2.57	$2.82	$2.82	$3.05	$3.30	$4.34
Raynham	$2.34	$2.34	$2.34	$2.34	$2.34	$2.34	$1.84	$1.84	$1.84		$1.84	$2.34	$2.57	$2.57	$2.82	$3.05	$4.11
Easton	$2.57	$2.57	$2.57	$2.57	$2.57	$2.57	$2.34	$2.34	$2.34	$1.84		$1.84	$2.34	$2.34	$2.57	$2.82	$3.86
Stoughton	$2.82	$2.82	$2.82	$2.82	$2.82	$2.82	$2.57	$2.57	$2.57	$2.34	$1.84		$1.84	$1.84	$2.34	$2.57	$3.39
Canton Ctr	$3.05	$3.05	$3.05	$3.05	$3.05	$3.05	$2.82	$2.82	$2.82	$2.57	$2.34	$1.84		$1.61	$1.84	$2.34	$2.91
Canton Jct	$3.05	$3.05	$3.05	$3.05	$3.05	$3.05	$2.82	$2.82	$2.82	$2.57	$2.34	$1.84	$1.61		$1.84	$2.34	$2.91
Route 128	$3.30	$3.30	$3.30	$3.30	$3.30	$3.30	$3.05	$3.05	$3.05	$2.82	$2.57	$2.34	$1.84	$1.84		$1.84	$2.68
Hyde Park	$3.59	$3.59	$3.59	$3.59	$3.59	$3.59	$3.30	$3.30	$3.30	$3.05	$2.82	$2.57	$2.34	$2.34	$1.84		$2.41
Boston	$4.50	$4.50	$4.50	$4.50	$4.50	$4.50	$4.34	$4.34	$4.34	$4.11	$3.86	$3.39	$2.91	$2.91	$2.68	$2.68	

Alternative 5 (Rapid Bus)

From \ To	Fall River	Freetown	New Bedford	Taunton	Boston
Fall River	-	-	-	-	$4.50
Freetown	-	-	-	-	$4.50
New Bedford	-	-	-	-	$4.50
Taunton	-		-	-	$4.34
Boston	$4.50	$4.50	$4.50	$4.34	-

* All fares are based on the 2006 MBTA fare structure.

** All new stations in Fall River and Newbedford were assigned Zone 8.

*** For the fare per commuter trip calculation, the monthly reduced pass fare was divded into 44 (22 commute day per month, two trips per day).

Alternative 6 (No Build/TSM)

	From	To	Fare (per trip)
Faill River	Fall River	Boston	$5.91
New Bedford	New Bedford	Taunton	$2.95
	New Bedford	Boston	$5.68
	Taunton	Boston	$4.59
Taunton	W. Bridgewater	Boston	$4.55
	Easton	Boston	$5.45
	Raynham	Boston	$5.45
	Taunton	Boston	$5.45

* No Build Conditions assumes that the existing commuter buses will continue providing the commuting services.

Appendix 3.2-H

CTPS Updated Ridership Analyses for the FEIS/FEIR

Note: This appendix provides two CTPS riderhip memos. The February 26, 2013 memo provides the most up-to-date ridership results for the Stoughton and Whittenton Alternatives (both electric and diesel variants). An earlier CTPS memo (December 17, 2012) pertains only to the Stoughton and Whittenton Electric Alternatives, but is included in this appendix because it also provides a discussion of the updates incorporated in the CTPS regional travel demand model since the work conducted for the DEIS/DEIR. Finally, please note that there is an error in Table 2, "South Coast Rail FEIR Selected Daily Auto and Transit Metrics For Air Quality " in the February 26, 2013 memo. The table does not include transit vehicle emissions (displaying results for automobile mode only). See Table 4.9-20 of the FEIS/FEIR for the summary of total regional emissions (including bus and rail transit emissions). The information in Table 4.9-20 was derived from detailed backup provided in Appendix C of the February 26, 2013 CTPS Memo.

DRAFT MEMORANDUM

DATE **February 26, 2013**

TO **Jean Fox, South Coast Rail Manager at MassDOT**

FROM **Scott Peterson, Director of Technical Services**

RE **FEIR Analysis – Updated Results including Diesel Options**

Introduction

In support of the South Coast Rail (SCR) environmental analysis, the Central Transportation Planning Staff (CTPS) was requested by the Massachusetts Department of Transportation (MassDOT) Office of Transportation Planning to conduct the travel demand analysis associated with the South Coast Rail Final Environmental Impact Report (FEIR) alternatives analysis. This was done using an updated version of the CTPS travel demand model that pivoted off of the work CTPS performed for the Draft Environmental Impact Report (DEIR). The improvements included updated demographic data for the future years and newer information on future year background transportation projects that are consistent with the Long Range Transportation Plans (LRTP) of the Metropolitan Planning Organizations (MPO's) in the study area. Seven scenarios were examined in this analysis. Five scenarios were examined using the travel demand model and the results of which were described in a memo dated December 17, 2012. Two new scenarios were added to the analysis since December 2012, which consist of diesel options for the Stoughton and Whittendon alternatives which have slower travel times and were examined using an elasticity based method.

1. Base Year – Year is 2010
2. True No-Build – Year is 2035
3. No-Build/Transportation System Management Option (TSM) – Year is 2035
4. Stoughton Electric Alternative – Year is 2035
5. Whittenton Electric Alternative – Year is 2035
6. Stoughton Diesel Alternative – Year is 2035
7. Whittenton Diesel Alternative – Year is 2035

The True No-build assumes land use changes and the transportation projects included in the LRTP. The True No-build includes existing private bus service from New Bedford, Fall River, and Taunton into Boston. The No-build/TSM pivots off of the True No-build and improves the frequency of the private bus operations serving the South Coast rail Study area. The two new scenarios examined using elasticities were diesel options of the Stoughton and Whittenton alternatives, number 6 and 7. Elasticities were used since the diesel operating plans mirrored those of the electric options, except for travel time. It is an accepted practice in the transportation planning profession to use elasticities when only one service plan variable changes, such as travel time.

The performance metrics examined, include linked and unlinked transit trips by mode, station boardings in the study area, Vehicle Miles Traveled (VMT) in the System, and emissions estimates for various pollutants.

Summary of Findings

The four key transit metrics presented in Table 1 consist of daily linked transit trips, daily unlinked trips, boardings on the commuter rail system, and boardings on the private buses serving the study area compared to the True No-Build scenario. Detailed breakdowns of the systemwide transit results are included in Appendix A. Station level and mode of access data are presented in Appendix B.

The transit system grows from 1.27 million unlinked transit trips in 2010 to 1.61 million in 2035 if there are no improvements to the transportation system other than what was included in the LRTP. The growth in unlinked transit trips is primarily due to demographics, but some transit improvements such as the Green Line Extension, Assembly Square Orange Line Station, and the new Fairmount Line Stations are adding to the increase in transit trips in the future. The TSM represents a slight improvement of the private bus system and this adds 2,210 unlinked transit trips to the system daily. The Stoughton Electric option adds 9,310 unlinked transit trips to the True No-Build, while the Whittenton Electric option adds 8,210 unlinked trips to the True No-Build. Relative to the TSM they add 7,100 and 6,000 unlinked transit trips, respectively. There are two reasons the Whittenton Electric option has less demand than the Stoughton Electric option:

- The service plan for the Whittenton Electric option has slower travel times from the southernmost stations to South Station than the Stoughton Electric option.
- The Whittenton Electric option has a different stop pattern in Taunton, which causes the additional travel time.

The diesel options for the Stoughton and Whittenton alternatives have slower travel times into Boston from New Bedford, Fall River, and Taunton, resulting in less demand relative to their electric options. The Stoughton Diesel option has 9,010 more unlinked trips than the True No-build, 300 less than the electric option. The Whittenton Diesel option has 8,010 more unlinked trips than the True No-build, 200 less than the electric option.

The daily system wide linked transit trips grows from 1.02 million 2010 to 1.29 million in the 2035 No-build scenario. The No-Build/TSM experiences a small improvement over the No-Build, adding 1,900 daily linked transit trips. The Stoughton Electric adds 7,400 more linked transit trips and the Whittenton Electric option adds 6,600 daily linked transit trips relative to the True No-build. The Stoughton Diesel option has 7,100 new linked transit trips and the Whittenton Diesel option 6,250 new linked transit trips relative to the True No-build. The reasons for these differences are the same as for the unlinked transit trips described above.

The commuter rail system, based on conductor's counts, had 145,000 daily boardings in 2010, which grows to 178,200 in the 2035 No-Build scenario. This increase is due to demographic growth and some improvements to the commuter rail system, examples of which are listed below.

- Fitchburg commuter rail travel time improvements
- Additional stations on the Fairmount Line
- Additional stations in Rhode Island on the Providence Line
- Yawkey Station is made a full-time stop

The No-Build/TSM causes a decrease in commuter rail boardings, by 490. This option adds bus service in the study area, which siphons off commuter rail riders from the Providence, Stoughton, and Middleborough commuter rail lines. The Stoughton Electric option adds 9,810 boardings daily to the commuter rail system and the Whittenton Electric option adds 8,910 boardings daily to the commuter rail system relative to the True No-build. The Stoughton Diesel option adds 9,260 boardings and the Whittenton Diesel option adds 8,460 boardings relative to the True No-build. This is between 450 and 550 lower than their corresponding electric options.

The private bus system in the study area had 1,600 daily boardings in 2010, but is forecasted to grow to 4,100 in the 2035 True No-Build scenario. The No-Build/TSM improves the private bus service in the South Coast rail corridor by adding frequency and this increases ridership to 6,000, an increase of 1,900 boardings. The Stoughton Electric option has 1,100 and the Whittenton Electric option 1,200 private bus trips relative to the True No-build. The Stoughton Diesel option has 1,250 private bus trips and the Whittenton Diesel option 1,350 new private bus trips relative to the True No-build. This is about 150 boardings more than the corresponding electric options.

Table 2 summarizes the traffic and CO2 metrics, while a more detailed breakdown of this information can be found in Appendix C. The emissions are a function of the change in passenger vehicles on the road due to the project and the change in transit vehicles being used. The No-Build/TSM with its improved bus service reduces passenger vehicle miles traveled (VMT) by 58,000 miles daily. The Stoughton Electric and Whittenton Electric options reduce VMT by 310,200 and 255,500 respectively. The change in VMT is a result people shifting from the auto mode to the transit option being improved. The vehicle hours traveled (VHT) is a proxy for time people spend in traffic as a result of congestion. The No-build/TSM reduces VHT by 3,300 hours daily. This reduction increases to 15,600 and 12,500 hours for the Stoughton Electric and Whittenton Electric options respectively. CO2 is a function of the VMT in this analysis and follows the same patterns, since this analysis didn't account for point source emissions (power plants) that produced the electricity. The diesel options, Stoughton and Whittendon, reduce VMT a little less than their electric counterparts: 297,200 and 243,500 respectively. Nitrous Oxide (NOx) experiences an increase in the TSM due to more bus emissions being produced than the passenger vehicles emissions from auto trips being diverted to transit are being reduced for NOx. Both electric options experience the greatest reduction thanks to the technology being used, ranging from minus 50 kg to minus 40 kg. The diesel options produce more NOx, due to the characteristics of diesel fuel being burnt, with both alternatives showing an increase in NOx of 20 to 30 kg daily. The pattern for the Volatile Organic Compounds (VOC) follow a similar pattern as NOx, with the exception that the TSM ends up showing a reduction of minus 10 kg along with both diesel options.

Conclusion

The electric options attracts more riders than the diesel option due to the faster travel times, which is a function of faster acceleration of the electric technology being used by the locomotives. Regardless of the technology, electric or diesel, the Stoughton alternative consistently attracts more riders than the Whittenton alternative especially for trips south of Taunton, where additional travel time is needed to traverse the Whittenton Junction. The travel time difference between the Stoughton and Whittenton alternatives is a more significant factor in attracting riders than the travel time differences associated with the technology, diesel versus electric. Auto diversions, vehicle miles of travel, and air quality were also examined in this analysis and the results will be presented in a subsequent memo. The air quality analysis shows that the technology drives the benefits. Electric technology provides significantly more emissions savings than the diesel options and the TSM alternative when you combine the transit vehicle emissions with the passenger vehicle emissions being saved.

TABLE 1
South Coast Rail FEIR
Daily Transit Results

Year Scenario	**2010** Existing Conditions	**2035** True No-Build	**2035** No-Build / TSM	**2035** Stoughton Electric	**2035** Whittenton Electric	**2035** Stoughton Diesel	**2035** Whittenton Diesel
Unlinked Transit Trips	1,270,700	1,612,000	1,614,210	1,621,310	1,620,210	1,621,010	1,620,010
Difference with True No-Build	na	na	2,210	9,310	8,210	9,010	8,010
Linked Transit Trip	1,018,000	1,294,400	1,296,300	1,301,800	1,301,000	1,301,500	1,300,650
Difference with True No-Build	na	na	1,900	7,400	6,600	7,100	6,250
Commuter Rail (1)	145,000	178,200	177,710	188,010	187,110	187,460	186,660
Difference with True No-Build	na	na	-490	9,810	8,910	9,260	8,460
Study Area Private Buses (2)	1,600	4,100	6,000	1,100	1,200	1,250	1,350
Difference with True No-Build	na	na	1,900	-3,000	-2,900	-3,000	-2,900

(1) Commuter system calibrated to conductors counts

(2) Study area means the South Coast Rail project study area

TABLE 2
South Coast Rail FEIR
Selected Daily Auto and Transit Metrics
For Air Quality

Year Scenario	2035 True No-Build	2035 No-Build / TSM	2035 Stoughton Electric	2035 Whittenton Electric	2035 Stoughton Diesel	2035 Whittenton Diesel
VMT	118,952,000	118,894,000	118,641,800	118,696,500	118,654,800	118,708,500
Difference with No-Build	na	-58,000	-310,200	-255,500	-297,200	-243,500
VHT	3,959,800	3,956,500	3,944,200	3,947,300	3,944,700	3,947,700
Difference with No-Build	na	-3,300	-15,600	-12,500	-15,100	-12,100
NOx (kg)						
Difference with No-Build	na	36	-61	-51	20	30
VOC (kg) Difference with No-Build	na	-10	-50	-40	-10	-10
CO2 (1)						
Difference with No-Build	na	-0.026	-0.193	-0.162	-0.106	-0.065

(1) in millions of kg

APPENDIX A
Systemwide Transit Summary

South Coast Rail FEIR
Systemwide Transit Summary

Average Daily Performance Measures for Transit Trips in the 182 Community Model Area	2006 Alternative	2010 Alternative	2035 True No-Build			2035 No-build/TSM			2035 Stoughton Electric			2035 Whittenton Electric			2035 Stoughton Diesel			2035 Whittenton Diesel		
	Base Year	Base Year	Boardings	% Diff with Base Year	Diff with Base Year	Boardings	% Diff with No-build	Diff with No-build	Boardings	% Diff with TSM	Diff with TSM	Boardings	% Diff with TSM	Diff with TSM	Boardings	% Diff with TSM	Diff with TSM	Boardings	% Diff with TSM	Diff with TSM
Middleboro Route CRR Line Total	11,000	10,600	11,200	9.8%	600	11,000	-1.8%	-200	10,600	-3.6%	-400	10,600	-3.6%	-400	10,650	-3.2%	-350	10,650	-3.2%	-350
Middleboro Route Inbound Total	5,500	5,300	5,600	9.8%	300	5,500	-1.8%	-100	5,300	-3.6%	-200	5,300	-3.6%	-200	5,325	-3.2%	-175	5,325	-3.2%	-175
Attleboro Route CRR Line Total	19,850	21,800	25,000	14.9%	3,200	24,700	-1.2%	-300	22,800	-7.7%	-1,900	23,000	-6.9%	-1,700	22,900	-7.3%	-1,800	23,100	-6.5%	-1,600
Attleboro Route Inbound Total	9,925	10,900	12,500	14.9%	1,600	12,350	-1.2%	-150	11,400	-7.7%	-950	11,500	-6.9%	-850	11,450	-7.3%	-900	11,550	-6.5%	-800
Stoughton Route CRR Line Total	9,750	8,600	9,300	8.4%	700	9,200	-1.1%	-100	21,700	135.9%	12,500	20,600	123.9%	11,400	21,000	128.3%	11,800	20,000	117.4%	10,800
Stoughton Route Inbound Total	4,875	4,300	4,650	8.4%	350	4,600	-1.1%	-50	10,850	135.9%	6,250	10,300	123.9%	5,700	10,500	128.3%	5,900	10,000	117.4%	5,400
Study Area CRR Lines	**40,600**	**41,000**	**45,500**	**11.0%**	**4,500**	**44,900**	**-1.3%**	**-600**	**55,100**	**22.7%**	**10,200**	**54,200**	**20.7%**	**9,300**	**54,550**	**21.5%**	**9,650**	**53,750**	**19.7%**	**8,850**
Study Area Inbound Total	20,300	20,500	22,750	11.0%	2,250	22,450	-1.3%	-300	27,550	22.7%	5,100	27,100	20.7%	4,650	27,275	21.5%	4,825	26,875	19.7%	4,425
Other CRR Lines	96,400	104,000	132,700	24.7%	28,700	132,810	0.1%	100	132,910	0.1%	100	132,910	0.1%	100	132,910	0.1%	100	132,910	0.1%	100
Total CRR - ALL Lines	137,000	145,000	178,200	22.9%	33,200	177,710	-0.3%	-500	188,010	5.8%	10,300	187,110	5.3%	9,400	187,460	5.5%	9,750	186,660	5.0%	8,950
SCR Rapid Bus Total	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SCR Private Buses	1,800	1,600	4,100	156.3%	2,500	6,000	46.3%	1,900	1,100	-81.7%	-4,900	1,200	-80.0%	-4,800	1,250	-79.2%	-4,750	1,350	-77.5%	-4,650
Study Area Transit (CRR+Prvt Bus)	**42,400**	**42,600**	**49,600**	**16.4%**	**7,000**	**50,900**	**2.6%**	**1,300**	**56,200**	**10.4%**	**5,300**	**55,400**	**8.8%**	**4,500**	**55,800**	**9.6%**	**4,900**	**55,100**	**8.3%**	**4,200**
MBTA Bus Total	370,600	380,700	464,800	22.1%	84,100	464,900	0.0%	100	465,200	0.1%	300	465,200	0.1%	300	465,300	0.1%	400	465,300	0.1%	400
Orange Line Total	159,600	170,200	226,900	33.3%	56,700	227,200	0.1%	300	227,800	0.3%	600	227,700	0.2%	500	227,800	0.3%	600	227,700	0.2%	500
Red Line Total	226,400	231,400	293,200	26.7%	61,800	293,300	0.0%	100	293,600	0.1%	300	293,500	0.1%	200	293,600	0.1%	300	293,500	0.1%	200
Blue Line Total	50,540	62,400	72,100	15.6%	9,700	72,100	0.0%	-	72,200	0.1%	100	72,200	0.1%	100	72,200	0.1%	100	72,200	0.1%	100
Green Line Total	237,400	249,400	312,000	25.1%	62,600	312,100	0.0%	100	312,300	0.1%	200	312,300	0.1%	200	312,300	0.1%	200	312,300	0.1%	200
Silver Line Phase I & II Total	20,200	25,600	56,100	119.1%	30,500	56,300	0.4%	200	56,500	0.4%	200	56,400	0.2%	100	56,500	0.4%	200	56,400	0.2%	100
Silver Line Phase I, II, & III Total	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Urban Ring Phase II	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Water Transportation	5,000	4,400	4,600	4.5%	200	4,600	0.0%	-	4,600	0.0%	-	4,600	0.0%	-	4,600	0.0%	-	4,600	0.0%	-
Unlinked Transit Trips	**1,208,540**	**1,270,700**	**1,612,000**	**26.9%**	**341,300**	**1,614,210**	**0.6%**	**2,200**	**1,621,310**	**0.4%**	**7,100**	**1,620,210**	**0.4%**	**6,000**	**1,621,010**	**0.4%**	**6,800**	**1,620,010**	**0.4%**	**5,800**
Linked Transit Trips	**1,013,700**	**1,018,000**	**1,294,400**	**27.2%**	**276,400**	**1,296,300**	**0.1%**	**1,900**	**1,301,800**	**0.4%**	**5,500**	**1,301,000**	**0.4%**	**4,700**	**1,301,500**	**0.4%**	**5,200**	**1,300,650**	**0.3%**	**4,350**
Walk Access (Walk+Xfer)	899,200	903,300	1,164,960	29.0%	261,660	1,165,500	0.0%	540	1,167,300	0.2%	1,800	1,167,000	0.1%	1,500	1,167,200	0.1%	1,700	1,166,900	0.1%	1,400
Drive Access (KNR+PNR)	114,500	114,700	129,440	12.9%	14,740	130,800	1.1%	1,360	134,500	2.8%	3,700	134,000	2.4%	3,200	134,300	2.7%	3,500	133,750	2.3%	2,950
Transfer Ratio	1.19	1.25	1.25		1.23	1.25		1.16	1.25		1.29	1.25		1.28	1.25		1.31	1.25		1.33

APPENDIX B

Station Level and Mode of Access Data

South Coast Rail Study
Station Boarding Results

DRAFT

Location / Corridor / Station		2010 Existing Conditions									
		Daily Boardings	Access Mode				Inbound Boardings				
			Walk	PNR	KNR	Transit	Total	AM	MD	PM	NT
Stoughton											
1	South Station	3,410	1,710	0	100	1,600	0	0	0	0	0
2	Back Bay	1,270	950	0	10	310	710	500	140	50	20
3	Ruggles	170	100	0	10	60	100	60	20	10	10
4	Hyde Park	560	250	280	30	0	440	310	90	40	0
5	Rte 128 Station	710	0	600	110	0	590	410	120	60	0
6	Canton Junction	720	120	510	90	0	700	460	160	70	10
7	Canton Center	710	370	270	70	0	710	470	160	70	10
8	Stoughton	1,050	240	670	140	0	1,050	780	200	50	20
10	North Easton	na	na	na	na	na	na	na	na	na	na
11	Easton Village	na	na	na	na	na	na	na	na	na	na
12	Raynham	na	na	na	na	na	na	na	na	na	na
13	Taunton	na	na	na	na	na	na	na	na	na	na
14	Dana Street	na	na	na	na	na	na	na	na	na	na
15	Taunton Depot	na	na	na	na	na	na	na	na	na	na
16	Freetown	na	na	na	na	na	na	na	na	na	na
17	Fall River Depot	na	na	na	na	na	na	na	na	na	na
18	Battleship Cove	na	na	na	na	na	na	na	na	na	na
19	Kings Hwy	na	na	na	na	na	na	na	na	na	na
20	Whales Tooth	na	na	na	na	na	na	na	na	na	na
	Stoughton Line Totals	**8,600**	**3,740**	**2,330**	**560**	**1,970**	**4,300**	**2,990**	**890**	**350**	**70**
		4,300									

South Coast Rail Study
Station Boarding Results

DRAFT

Location / Corridor / Station		2035 True No-build Daily Boardings	Access Mode: Walk	PNR	KNR	Transit	Inbound Boardings: Total	AM	MD	PM	NT
Stoughton											
1	South Station	3,690	1,850	0	110	1,730	0	0	0	0	0
2	Back Bay	1,370	1,030	0	10	330	770	540	150	50	30
3	Ruggles	180	100	0	10	70	110	70	20	10	10
4	Hyde Park	600	260	300	30	10	470	330	100	40	0
5	Rte 128 Station	760	0	650	110	0	630	440	130	60	0
6	Canton Junction	780	120	550	90	20	760	500	170	80	10
7	Canton Center	770	410	280	80	0	770	510	170	80	10
8	Stoughton	1,140	260	730	150	0	1,140	850	220	50	20
10	North Easton	na	na	na	na	na	na	na	na	na	na
11	Easton Village	na	na	na	na	na	na	na	na	na	na
12	Raynham	na	na	na	na	na	na	na	na	na	na
13	Taunton	na	na	na	na	na	na	na	na	na	na
14	Dana Street	na	na	na	na	na	na	na	na	na	na
15	Taunton Depot	na	na	na	na	na	na	na	na	na	na
16	Freetown	na	na	na	na	na	na	na	na	na	na
17	Fall River Depot	na	na	na	na	na	na	na	na	na	na
18	Battleship Cove	na	na	na	na	na	na	na	na	na	na
19	Kings Hwy	na	na	na	na	na	na	na	na	na	na
20	Whales Tooth	na	na	na	na	na	na	na	na	na	na
	Stoughton Line Totals	**9,300**	**4,030**	**2,510**	**590**	**2,160**	**4,650**	**3,240**	**960**	**370**	**80**
		4,650									

South Coast Rail Study
Station Boarding Results

DRAFT

Location / Corridor / Station		2035 TSM									
		Daily Boardings	Access Mode				Inbound Boardings				
			Walk	PNR	KNR	Transit	Total	AM	MD	PM	NT
Stoughton											
1	South Station	3,650	1,830	0	110	1,710	0	0	0	0	0
2	Back Bay	1,360	1,020	0	10	330	780	540	150	50	40
3	Ruggles	180	100	0	10	70	110	70	20	10	10
4	Hyde Park	590	260	300	30	0	460	320	100	40	0
5	Rte 128 Station	750	0	640	110	0	620	430	130	60	0
6	Canton Junction	770	120	550	90	10	750	500	170	80	0
7	Canton Center	760	400	280	80	0	760	510	170	80	0
8	Stoughton	1,120	260	710	150	0	1,120	850	220	50	0
10	North Easton	na	na	na	na	na	na	na	na	na	na
11	Easton Village	na	na	na	na	na	na	na	na	na	na
12	Raynham	na	na	na	na	na	na	na	na	na	na
13	Taunton	na	na	na	na	na	na	na	na	na	na
14	Dana Street	na	na	na	na	na	na	na	na	na	na
15	Taunton Depot	na	na	na	na	na	na	na	na	na	na
16	Freetown	na	na	na	na	na	na	na	na	na	na
17	Fall River Depot	na	na	na	na	na	na	na	na	na	na
18	Battleship Cove	na	na	na	na	na	na	na	na	na	na
19	Kings Hwy	na	na	na	na	na	na	na	na	na	na
20	Whales Tooth	na	na	na	na	na	na	na	na	na	na
	Stoughton Line Totals	**9,200**	**3,990**	**2,480**	**590**	**2,120**	**4,600**	**3,220**	**960**	**370**	**50**
		4,600									

DRAFT

South Coast Rail Study
Station Boarding Results

DRAFT

Location / Corridor / Station		2035 Stoughton Electric Daily Boardings	Access Mode Walk	PNR	KNR	Transit	Inbound Boardings Total	AM	MD	PM	NT
Stoughton											
1	South Station	9,470	4,740	0	280	4,450	0	0	0	0	0
2	Back Bay	3,690	2,770	0	40	880	880	610	170	70	30
3	Ruggles	220	130	0	10	80	120	80	20	10	10
4	Hyde Park	620	270	310	30	10	460	320	100	30	10
5	Rte 128 Station	760	0	650	110	0	600	420	130	50	0
6	Canton Junction	730	120	520	90	0	710	470	160	80	0
7	Canton Center	700	370	260	70	0	700	470	150	80	0
8	Stoughton	940	220	590	120	10	900	680	180	40	0
10	North Easton	460	110	320	30	0	450	310	80	50	10
11	Easton Village	150	120	0	30	0	150	120	20	10	0
12	Raynham	430	90	280	60	0	410	310	60	40	0
13	Taunton	670	230	260	120	60	620	480	100	40	0
14	Dana Street	na	na	na	na	na	na	na	na	na	na
15	Taunton Depot	400	80	220	60	40	380	290	60	30	0
16	Freetown	180	30	130	20	0	180	140	20	20	0
17	Fall River Depot	840	290	460	70	20	840	600	140	80	20
18	Battleship Cove	240	180	0	50	10	240	80	60	50	50
19	Kings Hwy	520	110	340	70	0	520	390	80	40	10
20	Whales Tooth	680	190	310	90	90	680	460	60	140	20
	Stoughton Line Totals	**21,700**	**10,050**	**4,650**	**1,350**	**5,650**	**8,840**	**6,230**	**1,590**	**860**	**160**
		10,850									

DRAFT

South Coast Rail Study
Station Boarding Results

DRAFT

Location / Corridor / Station		2035 Whittenton Electric: Daily Boardings	Access Mode: Walk	PNR	KNR	Transit	Inbound Boardings: Total	AM	MD	PM	NT
Stoughton											
1	South Station	8,990	4,500	0	270	4,220	0	0	0	0	0
2	Back Bay	3,500	2,630	0	40	830	830	580	160	70	20
3	Ruggles	210	120	0	10	80	110	70	20	10	10
4	Hyde Park	610	270	310	30	0	450	310	100	30	10
5	Rte 128 Station	800	0	680	120	0	630	440	140	50	0
6	Canton Junction	740	120	530	90	0	720	480	160	80	0
7	Canton Center	720	370	280	70	0	720	480	160	80	0
8	Stoughton	990	210	650	130	0	950	720	190	40	0
10	North Easton	490	110	350	30	0	480	330	90	50	10
11	Easton Village	150	120	0	30	0	150	120	20	10	0
12	Raynham	520	90	360	70	0	500	380	70	50	0
13	Taunton	na	na	na	na	na	na	na	na	na	na
14	Dana Street	320	50	220	50	0	310	240	50	20	0
15	Taunton Depot	360	70	210	60	20	340	260	50	30	0
16	Freetown	160	20	120	20	0	160	120	20	20	0
17	Fall River Depot	750	260	410	60	20	750	540	130	70	10
18	Battleship Cove	200	150	0	40	10	200	70	50	40	40
19	Kings Hwy	480	110	310	60	0	480	360	70	40	10
20	Whales Tooth	610	170	290	90	60	610	410	50	130	20
	Stoughton Line Totals	**20,600**	**9,370**	**4,720**	**1,270**	**5,240**	**8,390**	**5,910**	**1,530**	**820**	**130**
		10,300									

South Coast Rail Study
Station Boarding Results

DRAFT

Location / Corridor / Station		2035 Stoughton Diesel									
		Daily Boardings	Access Mode				Inbound Boardings				
			Walk	PNR	KNR	Transit	Total	AM	MD	PM	NT
Stoughton											
1	South Station	9,150	4,590	0	290	4,270	0	0	0	0	0
2	Back Bay	3,570	2,680	0	40	850	880	610	170	70	30
3	Ruggles	210	120	0	10	80	110	70	20	10	10
4	Hyde Park	600	260	300	30	10	460	320	100	30	10
5	Rte 128 Station	740	0	620	110	10	600	410	130	50	10
6	Canton Junction	710	110	490	90	20	710	460	160	80	10
7	Canton Center	680	360	250	70	0	670	440	140	80	10
8	Stoughton	910	210	560	120	20	860	650	170	40	0
10	North Easton	450	110	320	20	0	430	300	80	50	0
11	Easton Village	150	120	0	30	0	140	110	20	10	0
12	Raynham	420	90	280	50	0	390	290	60	40	0
13	Taunton	650	230	250	120	50	590	460	100	40	-10
14	Dana Street	na	na	na	na	na	na	na	na	na	na
15	Taunton Depot	390	80	220	60	30	360	270	60	30	0
16	Freetown	170	30	130	10	0	170	130	20	20	0
17	Fall River Depot	810	280	450	60	20	800	570	130	80	20
18	Battleship Cove	230	170	0	50	10	230	80	60	50	40
19	Kings Hwy	500	110	330	60	0	500	380	80	40	0
20	Whales Tooth	660	180	300	90	90	650	440	60	130	20
	Stoughton Line Totals	**21,000**	**9,730**	**4,500**	**1,310**	**5,460**	**8,550**	**5,990**	**1,560**	**850**	**150**
		10,500									

South Coast Rail Study
Station Boarding Results

DRAFT

Location		2035 Whittenton Diesel									
Corridor		Daily	Access Mode				Inbound Boardings				
	Station	Boardings	Walk	PNR	KNR	Transit	Total	AM	MD	PM	NT
Stoughton											
1	South Station	8,720	4,370	0	290	4,060	0	0	0	0	0
2	Back Bay	3,400	2,550	0	30	820	830	580	160	70	20
3	Ruggles	200	110	0	10	80	110	70	20	10	10
4	Hyde Park	590	260	300	30	0	450	310	100	30	10
5	Rte 128 Station	780	0	650	120	10	630	430	140	50	10
6	Canton Junction	720	120	510	90	0	720	470	160	80	10
7	Canton Center	700	360	270	70	0	690	450	150	80	10
8	Stoughton	960	200	630	120	10	910	690	180	40	0
10	North Easton	480	110	350	20	0	460	320	90	50	0
11	Easton Village	150	120	0	30	0	140	110	20	10	0
12	Raynham	500	90	350	60	0	480	360	70	50	0
13	Taunton	na	na	na	na	na	na	na	na	na	na
14	Dana Street	310	50	220	40	0	300	230	50	20	0
15	Taunton Depot	350	70	200	60	20	330	250	50	30	0
16	Freetown	160	20	120	20	0	150	110	20	20	0
17	Fall River Depot	730	260	390	60	20	720	520	120	70	10
18	Battleship Cove	190	140	0	40	10	190	70	50	40	30
19	Kings Hwy	470	100	310	60	0	460	350	70	40	0
20	Whales Tooth	590	170	280	80	60	580	390	50	120	20
	Stoughton Line Totals	**20,000**	**9,100**	**4,580**	**1,230**	**5,090**	**8,150**	**5,710**	**1,500**	**810**	**130**
		10,000									

APPENDIX C
Highway and Transit Air Quality Metrics

South Coast Rail FEIR Study
Vehicle Emissions

DRAFT

Scenario	South Coast Rail FEIR Avg. Weekday Performance Measures								
	Auto Mode								
	VMT	VHT	MPH	CO kg	NOx kg	VOC kg	CO2 kg	PM2.5 kg	PM10 kg
2010 Base	109,926,000	3,655,700	30.07	1,516,100	118,010	48,810	61,190,310	3,010	4,780

Notes: VMT adjusted with HPMS data

All emission factors were developed using MOBILE 6.2, with inputs developed by MA DEP

CO emission factors are based on winter temperature and humidity assumptions

VOC, Nox, CO2, PM 2.5, and PM10 emission factors are based on summer temperature and humidity assumptions

South Coast Rail FEIR Study
Vehicle Emissions

DRAFT

Scenario	Linked Transit Trip	VMT	VHT	MPH	Avg Trip Length	CO kg	NOx kg	VOC kg	CO2 kg	PM2.5 kg	PM10 kg
	South Coast Rail FEIR 2035 Auto Mode Avg. Weekday Performance Measures										
Auto Mode Emissions											
NB	1,294,400	118,952,000	3,959,800	30.04	na	1,050,860	19,220	22,210	67,745,200	1,490	3,240
TSM	1,296,300	118,894,000	3,956,500	30.05	na	1,050,350	19,220	22,200	67,712,170	1,490	3,230
SLE	1,301,800	118,641,800	3,944,200	30.08	na	1,048,120	19,170	22,160	67,568,540	1,490	3,230
WLE	1,301,000	118,696,500	3,947,300	30.07	na	1,048,600	19,180	22,170	67,599,690	1,490	3,230
SLD	1,301,500	118,654,800	3,944,700	30.08	na	1,048,230	19,170	22,160	67,575,940	1,490	3,230
WLD	1,300,650	118,708,500	3,947,700	30.07	na	1,048,710	19,180	22,170	67,606,520	1,490	3,230
Auto Mode Emissions Deltas Relative to the No-build											
NB	na	na	na	na	na	na	na	na	na	na	na
TSM	1,900	-58,000	-3,300	0.01	30.5	-510	0	-10	-33,030	0	-10
SLE	7,400	-310,200	-15,600	0.04	41.9	-2,740	-50	-50	-176,660	0	-10
WLE	6,600	-255,500	-12,500	0.03	38.7	-2,260	-40	-40	-145,510	0	-10
SLD	7,100	-297,200	-15,100	0.04	41.9	-2,630	-50	-50	-169,260	0	-10
WLD	6,250	-243,500	-12,100	0.03	38.7	-2,150	-40	-40	-138,680	0	-10
Auto Mode Emissions Deltas Relative to the TSM											
NB	-1,900	58,000	3,300	-0.01	30.5	510	0	10	33,030	0	10
TSM	na	na	na	na	na	na	na	na	na	na	na
SLE	5,500	-252,200	-12,300	0.03	45.9	-2,230	-50	-40	-143,630	0	0
WLE	4,700	-197,500	-9,200	0.02	42.0	-1,750	-40	-30	-112,480	0	0
SLD	5,200	-239,200	-11,800	0.03	46.0	-2,120	-50	-40	-136,230	0	0
WLD	4,350	-185,500	-8,800	0.02	42.6	-1,640	-40	-30	-105,650	0	0

South Coast Rail FEIR Study
Vehicle Emissions

DRAFT

Scenario	South Coast Rail FEIR 2035 Transit Vehicles Avg. Weekday Performance Measures						
	VMT	CO kg	NOx kg	VOC kg	CO2 kg	PM2.5 kg	PM10 kg

Transit Vehicle Emissions Deltas Relative to the No-build

Scenario	VMT	CO kg	NOx kg	VOC kg	CO2 kg	PM2.5 kg	PM10 kg
NB	na	na	na	na	na	na	na
TSM	3,192	6	36	0	6,566	0	0
SLE	-540	-46	-11	0	-16,541	0	0
WLE	-540	-46	-11	0	-16,541	0	0
SLD	2,044	170	40	0	62,890	1	1
WLD	2,386	198	47	0	73,411	1	1

Transit Vehicle Emissions Deltas Relative to the TSM

Scenario	VMT	CO kg	NOx kg	VOC kg	CO2 kg	PM2.5 kg	PM10 kg
NB	-3,192	-6	-36	0	-6,566	0	0
TSM	na	na	na	na	na	na	na
SLE	-3,732	-51	-48	0	-23,108	0	0
WLE	-3,732	-51	-48	0	-23,108	0	0
SLD	-1,148	164	4	0	56,324	1	1
WLD	-806	192	11	0	66,845	1	1

South Coast Rail FEIR Study
Vehicle Emissions

DRAFT

Scenario	South Coast Rail FEIR 2035 Total Avg. Weekday Performance Measures VMT	CO kg	NOx kg	VOC kg	CO2 kg	PM2.5 kg	PM10 kg
Total Vehicle Emissions Deltas Relative to the No-build							
NB	na	na	na	na	na	na	na
TSM	-54,808	-504	36	-10	-26,464	0	-10
SLE	-310,740	-2,786	-61	-50	-193,201	0	-10
WLE	-256,040	-2,306	-51	-40	-162,051	0	-10
SLD	-295,156	-2,460	-10	-50	-106,370	1	-9
WLD	-241,114	-1,952	7	-40	-65,269	1	-9
Total Vehicle Emissions Deltas Relative to the TSM							
NB	54,808	504	-36	10	26,464	0	10
TSM	na	na	na	na	na	na	na
SLE	-255,932	-2,281	-98	-40	-166,738	0	0
WLE	-201,232	-1,801	-88	-30	-135,588	0	0
SLD	-240,348	-1,956	-46	-40	-79,906	1	1
WLD	-186,306	-1,448	-29	-30	-38,805	1	1

DRAFT MEMORANDUM

DATE **December 17, 2012**

TO **Jean Fox, South Coast Rail Manager at MassDOT**

FROM **Scott Peterson, Director of Technical Services**

RE **Results of the FEIR Analysis**

Introduction

In support of the South Coast Rail (SCR) environmental analysis, the Central Transportation Planning Staff (CTPS) was requested by the Massachusetts Department of Transportation (MassDOT) Office of Transportation Planning to conduct the regional travel demand modeling work associated with the South Coast Rail Final Environmental Impact Report (FEIR) alternatives analysis. This was done using an updated version of the CTPS travel demand model that pivoted off of the work CTPS performed for the Draft Environmental Impact Report (DEIR). The improvements included updated demographic data for the future years and newer information on future year background transportation projects that are consistent with the Long Range Transportation Plans (LRTP) of the MPO's in the study area. Five scenarios were modeled:

1. Base Year – Year is 2010
2. No-Build – Year is 2035
3. No-Build/Transportation Management System Option (TSM) – Year is 2035
4. Stoughton Electric Alternative – Year is 2035
5. Whittendon Electric Alternative – Year is 2035

The performance metrics examined, include linked and unlinked transit trips by mode, station boarding's in the study area, Vehicle Miles Traveled (VMT) in the System, and emissions estimates for various pollutants.

Summary of Findings

The four key transit metrics presented in Table 1 consist of daily linked transit trips, daily unlinked trips, boardings on the commuter rail system, and boardings on the private buses serving the study area compared to the No-Build scenario. Detailed breakdowns of the transit results are included in Appendix A. Station level and mode of access data are presented in Appendix B.

The transit system grows from 1.27 million unlinked transit trips in 2010 to 1.6 million in 2035 if there are no improvements to the transportation system other than what was included in the LRTP. The growth in unlinked transit trips is primarily due to demographics, but some transit improvements such as the Green Line Extension, Assembly Square Orange Line Station, and the new Fairmount Stations are adding to the increase in transit trips in the future. The TSM represents a slight improvement of the private bus system and this adds 2,200 unlinked transit trips to the system daily. The Stoughton Electric option adds 9,310 unlinked transit trips to the No-Build, while the Whittendon Electric option adds a 8,210 unlinked trips to the No-Build. Relative to the TSM they add 7,100 and 6,000 unlinked transit trips. There are two reasons the Whittendon Electric option has less demand than the Stoughton Electric option:

- The service plan for the Whittendon Electric option has slower travel times from the southernmost stations to South Station than the Stoughton Electric option.
- The Whittendon Electric option has a different stop pattern in Taunton, which causes the additional travel time.

TABLE 1

South Couth Rail FEIR

Daily Transit Results

Year Scenario	**2010** Existing Conditions	**2035** No-Build	**2035** No-Build / TSM	**2035** Stoughton Electric	**2035** Whittendon Electric
Unlinked Transit Trips	1,270,700	1,612,000	1,614,210	1,621,310	1,620,210
Difference with No-Build	na	na	2,210	9,310	8,210
Linked Transit Trip	1,018,000	1,294,400	1,296,300	1,301,800	1,301,000
Difference with No-Build	na	na	1,900	7,400	6,600
Commuter Rail (1)	145,000	178,200	177,710	188,010	187,110
Difference with No-Build	na	na	-490	9,810	8,910
Study Area Private Buses (2)	1,600	4,100	6,000	1,100	1,200
Difference with No-Build	na	na	1,900	-3,000	-2,900

(1) Commuter system calibrated to conductors counts
(2) Study area means the South Coast Rail project study area

The daily system wide linked transit trips grows from 1.02 million 2010 to 1.29 million in the 2035 No-build scenario. The No-Build/TSM experiences a small improvement over the No-Build, adding 1,900 daily linked transit trips. The Stoughton Electric adds 7,400 more linked transit trips and the Whittendon Electric option adds 6,600 daily linked transit trips. Relative to the TSM they add between 5,500 and 4,700 linked transit trips. The reasons for these differences are the same as for the unlinked transit trips described above. In this analysis, a linked transit trips is also closely related to auto diversions and discussed later in this section, differing only by the number of people that may carpool together.

The commuter rail system, based on conductor's counts, had 145,000 daily boardings in 2010, which grows to 178,200 in the 2035 No-Build scenario. This increase is due to demographic growth and some improvements to the commuter rail system, examples of which are listed below.

- Fitchburg commuter rail travel time improvements
- Additional stations on the Fairmount Line
- Additional stations in Rhode Island on the Providence Line
- Yawkey Station is made a full-time stop

The No-Build/TSM causes a decrease in commuter rail boardings, by 490. This option adds bus service in the study area, which siphons of commuter rail riders from the Providence, Stoughton, and Middleborough commuter rail lines. The Stoughton Electric option adds 9,810 boardings daily to the commuter rail system. The Whittendon Electric option adds 8,910 boardings daily to the commuter rail system.

The private bus system in the study area had 1,600 daily boardings in 2010, which is expected to grow to 4,100 in the 2035 No-Build scenario. The No-Build/TSM additional bus service adds service and increases ridership to 6,000, an increase of 1,900 boardings. Both commuter rail options provide more stations in the study area and offer faster travel times to South Station, resulting a loss of private bus boardings.

Table 2 summarizes the traffic and CO2 metrics, while a more detailed breakdown of this information can be found in Appendix C. The No-Build/TSM with its improved bus service reduces vehicle miles traveled (VMT) by 58,000 miles daily. The Stoughton Electric and Whittendon options reduce VMT by 310,200 and 255,500 respectively. The change in VMT is a result people shifting from the auto mode to the transit option being improved. The vehicle hours traveled (VHT) is a proxy for time people spend in traffic as a result of congestion. The No-build/TSM reduces VHT by 3,300 hours daily. This reduction increases to 15,600 and 12,500 hours for the Stoughton Electric and Whittendon Electric options respectively. CO2 is a function of the VMT in this analysis and follows the same patterns.

TABLE 2
South Couth Rail FEIR
Daily Highway and CO2 Results

Year	2035	2035	2035	2035
Scenario	No-Build	No-Build / TSM	Stoughton Electric	Whittendon Electric
VMT	118,952,000	118,894,000	118,641,800	118,696,500
Difference with No-Build	na	-58,000	-310,200	-255,500
VHT	3,959,800	3,956,500	3,944,200	3,947,300
Difference with No-Build	na	-3,300	-15,600	-12,500
CO2 (1)	67.745	67.712	67.569	67.600
Difference with No-Build	na	-0.033	-0.176	-0.145

(1) in millions of kg

Overview of the Model

The model set is of the same type as those used in most large urban areas in North America. It is used to simulate existing travel conditions and to forecast future-year travel on the entire transportation system spanning eastern Massachusetts, for the transit, auto, and walk/bike modes. The travel demand model is a tool that uses the best transportation networks, and input data available to CTPS at this time. The model set simulates multiple modes of travel for trips between areas in the modeled region, eastern Massachusetts. Population, employment, number of households, auto ownership, highway and transit levels of service, downtown parking costs, auto operating costs and transit fares are some of the most important inputs that are used in applying the model to a real world situation. These inputs are periodically updated so that the model set simulates current travel patterns with as much accuracy as possible.

The CTPS travel model set has been used in numerous modeling activities; examples include the Green Line Extension New Starts Study, and several Air Quality Conformity Determinations and LRTP for the Boston Region Metropolitan Planning Organization (MPO). In light of these activities, the four-step modeling methodology has been reviewed and accepted by the Federal Transit Administration (FTA) and the Federal Highway Administration (FHWA) for regional planning activities.

Major Features of the Model

Some important features of the model set are listed below.

1. The modeled area encompasses 182 cities and towns in eastern Massachusetts. The area is divided into 2,918 internal Transportation Analysis Zones (TAZ's). There are 146 external stations around the periphery of the modeled area that allow for travel between the modeled area and adjacent areas of Massachusetts, New Hampshire, and Rhode Island.

2. The model set was developed using data from a Household Travel Survey, an External Cordon Survey, several Transit Passenger Surveys, the 2010 U.S. Census data, an employment database for the region, and a vast database of ground counts of transit ridership and traffic volume data collected over the last decade. CTPS obtained the most current transit ridership data and highway volumes available to help calibrate the model for use in this study.

3. The transportation system is broken down into three primary modes. The transit mode contains all the MBTA rail and bus lines, commuter boat services, regional transit agencies, and private express bus carriers. The auto mode includes all of the express highways, all of the principal arterials, and many minor arterials and local roadways. Walk/bike trips are also examined and are represented in the non-motorized mode.

4. The model is set up to examine travel on an average weekday for four time periods. The time periods are AM peak (3 hrs.), Midday (6 hrs.), PM peak (3 hrs.), and Night (12 hrs.) The base year is 2010. The forecast year is 2035.

The Four-Step Model Methodology

The model set is based on the traditional four-step urban transportation planning process of trip generation, trip distribution, mode choice, and trip assignment. This process is used to estimate the daily transit ridership and highway traffic volumes, based on changes to the transportation system. The model set as it relates to transit takes into consideration data on service frequency (i.e. how often trains and buses arrive at any given transit stop), routing, travel time, transit parking availability, and fares for all of the transit services. The model set on the roadway system is sensitive to roadway locations, connectivity, length, speeds, capacity, lanes, truck exclusions, turn prohibitions, and tolls. Results from the computer model provide us with detailed information relating to transit ridership demand and roadway travel.

<u>The Four-Step Model</u>

1. Trip Generation: In the first step, the total number of trips produced by the residents in the model area is calculated using demographic and socio-economic data. Similarly, the numbers of trips attracted by different types of land use such as employment centers, schools, hospitals, shopping centers etc., are estimated using

land use data and trip generation rates obtained from travel surveys. All of these calculations are performed at the TAZ level.

2. Trip Distribution: In the second step, the model determines how the trips produced and attracted would be matched throughout the region. Trips are distributed based on transit and highway travel times between TAZ and the relative attractiveness of each TAZ.

3. Mode Choice: Once the total number of trips between all combinations of TAZ's is determined, the mode choice step of the model splits the total trips among the available modes of travel. The modes of travel are walk/bike, auto, and transit. To determine what proportions of trips each mode receives, the model takes into account the travel times and costs associated with these options. Some of the other variables used in the mode choice modeling are auto ownership rates, household size, and income.

4. Assignment: After estimating the number of trips by mode for all possible TAZ combinations, the model assigns them to their respective transportation networks, auto or transit. Reports are produced showing the transit and highway usage and the impact on regional air quality.

Application of the Model

Once the calibration was complete, the model was run for the forecast year, 2035, using future year inputs such as projected population and employment by TAZ, in addition to transportation system characteristics. The demographic forecasts were created by the local Regional Planning Agencies (RPAs) in the model area such as the Southeastern Regional Planning and Economic Development District (SRPEDD), Old Colony Planning Council (OCPC), and Metropolitan Area Planning Council (MAPC) for use in their most currently adopted LRTP.

Service Plan

The project team provided CTPS with the service plan for the No-Build/TSM, Stoughton Electric and Whittendon Electric options. The service plan consisted station locations, fares, parking information, frequency of service by time period, and travel times between stations. The service plan information is included in the consultant's report.

Comparison with DEIR Analysis

The FEIR results are differ from the DEIR in several ways. The base year was updated from 2006 to 2010. The forecast year was extended out to from 2030 in the DEIR to 2035 in the FEIR. The list of transportation projects in the LRTP is also significantly different. The DEIR included the Urban Ring Phase II, the Silver Line Phase III connection, and a host of other projects that are not included in the most current fiscally constrained LRTP. The land use is another important change. The 2030 forecasts were developed with an eye towards a lot of population growth in the suburbs and employment growth in the major cities, like Boston and Taunton in the study area. Given the current economic climate, the 2035 forecasts have been scaled back in absolute numbers, along with a more targeted smart growth approach. The FEIR service plans for the Stoughton Electric and Whittendon options also differ slightly from those used in the DEIR, being more refined and the FEIR now includes a feeder bus network that compliments the proposed stations.

All of these changes have led to demand estimates in the FEIR that are between 10% and 20% lower for the bus and commuter alternatives than were estimated in the DEIR. The most significant change is the land use assumed in 2035, which drives the trip making from population locations (South Coast Rail Study area) to employment centers, namely Boston and Cambridge.

Conclusion

The results of this analysis show that the Stoughton and Whittendon Electric options capture a significant number of trips, between 7,400 and 6,600 respectively on a daily basis in 2035 relative to the No-Build scenario that would have otherwise been made by auto. This translates into a VMT savings, VHT reduction, and emissions benefits, which are shown in Table 2. The major difference between the two commuter rail alternatives are travel times for trains traveling the outer stations, south of Taunton, into Boston. The longer travel times from New Bedford and Fall River up through Taunton in the Whittendon Electric option reduces demand at these stations (see Appendix B). The stations in Taunton also see a reduction in the Whittendon Electric option, but drive access demand increases at Raynham Station, due to people willing to bypass the slower segment of train travel and pick up the line north of the delay during the AM time inbound commute. These results show the same pattern as observed in the DEIR for the electric options, although they are showing less demand. This is primarily a function of the most current RPA adopted land use assumptions in the model area and represents a more conservative view of future smart growth strategy consistent with the South Coast Rail Corridor Plan.

cc: Steve Woelfel, MassDOT
Natasha Velickovic, VHB
Ying Bao, CTPS
Grace King, CTPS

Note: Appendices to the December 17, 2012 CTPS Ridership Memo are omitted because they are superseded by the appendices to the February 26, 2013 CTPS Ridership Memo, provided earlier in this appendix to the FEIS/FEIR.